FORESTRY ABSTRACTS

VOLUME 7 1946 NUMBER 3

PLANS FOR ABSTRACTING AND STATISTICAL SERVICES

THE Technical Committee on Forestry and Primary Forest Products presented its first report to the United Nations Interim Commission on Food and Agriculture (FAO) in November, 1944, and the report was later transmitted to the Governments of the United Nations [cf. *For. Abstr.* 7 (No. 1458)]. The Committee's second report was submitted in April, 1945; its purpose is to examine the need and opportunities for international action after the war and to outline a specific programme for forestry and primary forest products, and it is based largely on recent factual material assembled by questionnaires and supporting documents.

Among the Committee's many specific recommendations covering policies and plans in the entire field of world forestry and primary forest products [cf. *For. Abstr.* 7 (No. 1459)] are several dealing with the future organization of information services concerned with current literature and statistics. Up to World War II persons interested in forestry and forest products were accustomed to receive a number of official or semi-official international periodicals dealing solely or mainly with these subjects: the more important being *International Yearbook of Forestry Statistics* and the monographs and bulletins published by the International Institute of Agriculture: *Yearbook of World Timber Trade*, *Timber Statistical Review* (monthly), *International Timber Trade Reports* (supplement to *European Timber Exports*, monthly), *International Review on Timber Utilization* issued by the Comité International du Bois: *Intersylva* (quarterly), *Silvae Orbis* (monographs) and *Bibliographia Forestalis* issued by the Centre International de Sylviculture: *Forstliche Rundschau* published by the German Institute for Foreign and Colonial Forestry: and *Forestry Abstracts* with its supplementary publications by the Imperial Forestry Bureau. Sections of *Biological Abstracts* and *Chemical Abstracts* also covered the field of sciences related to forestry.

The Committee's views and recommendations on the future organization of such information services are detailed below but it should be understood that they represent personal—albeit unanimous—views and have yet to be endorsed by the Commission.

International collaboration in research: It is recommended that FAO should succeed the International Union of Forest Research Organizations as a world clearing-house of forestry research activities; and should seek to ensure full coverage of all research work through up-to-date abstracting services, and should promote regular contacts between agricultural and forestry research, which have much in common in the field of natural sciences.

International forestry statistics: Among the major statistical tasks to which FAO should devote immediate attention are (i) Resumption of international forestry statistics.—The International Institute of Agriculture issued periodical forestry publications and three forestry yearbooks between 1936 and 1942 (on Europe, America and Africa); no attempt was made to compare or interpret the data or to develop regular forestry yearbooks. The Comité International du Bois did considerable work in developing the regularity and comparability of international statistics on timber trade, sales and prices. Just before the war this body also began to assemble statistics concerning forest industries and wood consumption. The Centre International de Sylviculture, after its establishment in Berlin, undertook considerable processing and interpretation of primary statistical material. Converting all forest products into their round-wood equivalent it began to draw up balance sheets by countries on forest products. All such work should now be assumed by FAO without delay. It should publish a volume bridging the wartime gap and bringing forestry information up-to-date; and should thereafter organize a regular intelligence service which would rely on the co-operation of governments, forestry associations, forest schools and other organizations capable of supplying information.

And (ii) Preparation of a world forest census.—A forest census, repeated at fixed intervals, would result in the compilation of the best available information at a given point and indicate major gaps that need to be filled.

Wood Utilization: The Committee proposes that FAO should become a world centre of knowledge of wood utilization, and should see that good abstracting services are available covering the entire field, building up well-classified files and library for consultation by specialists.

Forest Products: An up-to-date record should be kept by FAO of the capacity of forest industries in all major forest regions and of forest industrial programmes in all countries. This information should be analysed, tabulated and incorporated in an annual report.

Lumber: FAO should take over as soon as possible the activities of the Comité International du Bois (the organization concerned with world lumber problems), and prepare periodic publications of world statistics and other information on production, stocks, prices and international trade in lumber.

Pulp: Regular statistics should similarly be supplied on the production, stocks, prices and international trade in pulp and the major pulp products.

Veneer and Plywood: In addition to the publication of regular statistics covering the raw materials and the products of the veneer industry, FAO should study plywood consumption trends and the supply prospects of veneer logs.

Minor Forest Products: The same services, viz.—world statistics, studies of consumption trends, technical information and advice, that are to be provided for the three leading forest products should be developed for each of the minor products.

Briefly recapitulated, the principal publications to which FAO's statistical and information bureaux should give priority are: (*a*) An up-to-date yearbook of world timber and pulp trade, containing information on the period since 1937. (*b*) Quarterly publication of data on imports, exports, stocks, production and prices of lumber, pulpwood, pulp and plywood. (*c*) An up-to-date yearbook of forestry statistics based on the yearbooks of the International Institute of Agriculture, dealing with areas, standing volume, annual growth and annual drain.

The recommendations of the Technical Committee on Statistics endorse those of the Forestry Committee as to annual and quarterly publications on statistics but stress the value of monthly statistical bulletins. Since monthly statistics are mainly required for study of market trends they are probably most usefully published on a commodity basis, a separate series for each product or group of products. Later on, an enlarged number summarising statistics for the previous three months might replace the quarterlies.

C. F. C. B.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

02. TEXTBOOKS. COMPENDIA

02.1 (485). Kort handledning i skogshushållning. [**A short introduction to general forestry.**] Norrlands Skogsvårdsförbunds Förlag, Stockholm. 4th ed., 1941. pp. viii + 511. [Sw.] [1015].

The present edition of this work, designed as a textbook on general forestry for preliminary instruction and private study, has been completely revised under the editorship of Dr. A. Holmgren with the assistance of specialists, and has been approved by representatives of the State forestry schools. The 30 chapters deal with:—The place of Swedish forests in national economy; historical development of the forests; forest soils (37 pp.); morphology and anatomy of trees; biology of trees; Swedish tree species (63 pp.); keys to deciduous trees in the winter state and to the woods of common species; plant associations; the forest stand; types of fellings and natural regeneration (17 pp.); artificial regeneration (26 pp.); tending operations (18 pp.); livestock management; injurious fungi (20 pp.); injurious animals (18 pp.); forest fires; nature protection; forest drainage (17 pp.); the technical properties of wood; assortments; logging, scaling and transport (53 pp.); forest roads; timber floating; sawmilling; the pulp industry, charcoal burning (39 pp.); wood-tar manufacture; surveying (20 pp.); mensuration and valuation (29 pp.); and forest management proper. The figures quoted (for all sections of more than 15 pp.) are a rough index to the chief emphasis of the book. The treatment throughout is somewhat elementary and there are numerous clear illustrations but no index.

02.1 (485). Anvisningar i skogsbruk. [**Instructions in forestry.**] Svenska Skogsvårdsföreningens Förlag, Stockholm. 6th ed., 1943. pp. 275. [Sw.] [1016].

This manual, revised up to 1943, is published for use in forestry and agricultural courses, national colleges, and by owners of small forests. It covers much the same ground as 'Kort handledning i skogshushållning' [cf. preceding abstract], though in a briefer and rather more popular manner, and the relative space devoted to the various topics is very similar. The chapters are as follows:—Forests of the world; importance of forests in Sweden; forest soils; morphology, anatomy and biology of trees; immigration of forest trees and their present distribution; associations; the forest stand and its characters; natural and artificial regeneration; other silvicultural measures; drainage; timber assortments; logging, extraction and sale of timber; the wood and pulp industries; charcoal and tar manufacture; wood for estate purposes; summer livestock grazing and forestry; measurement of trees and timber; forest management and valuation; damage by fungi and animals; forest fires; forest legislation and educational propaganda; nature protection; game and fish management; rational management of small forests; and bookkeeping for forest owners.

02.2 (485) : 09.4. Praktisk skogshandbok. [**Practical forest handbook.**] Norrlands Skogsvårdsförbunds Förlag, Stockholm. 4th ed., 1944. pp. xi + 402. [Sw.] [1017].

A condensed reference book for practical foresters in Sweden, containing data useful for management in the broad sense. The section headings are:—Sweden's forests according to the State forest survey; forest seed; nursery practice; artificial regeneration; marking; pruning; drainage; fencing; mensuration of standing timber; forest management proper; valuation; tree and stand tables; technical properties of wood; scaling; assortments; piece-work tables; scaling and grading rules for sawtimber; summer storage of timber in the woods; horse, motor and rail transport; charcoal burning; sawmilling; wood-tar distillation; building

construction for small estates; cement and concrete work; agricultural data; livestock grazing; forest roads; miscellaneous tables and formulae; use of the slide rule; the Forest Conservation Law (with text); and an extract from the law regarding the occurrence and control of forest fires. There is also an index by subjects.

05. PERIODICALS

05.3. *Annual Reports*

05.3 (410). GREAT BRITAIN. **Imperial Agricultural Bureaux: fifteenth annual report of the Executive Council, 1943–44.** H.M. Stationery Office, London. 1945. pp. 24. [1018].

05.3 (410). GREAT BRITAIN. **The annual report of the Agricultural and Horticultural Research Station (the National Fruit and Cider Institute), Long Ashton, Bristol, 1944.** University of Bristol Agricultural and Horticultural Research Station, Long Ashton. [1945?]. pp. 227 + plates. [1019].

05.3 (66.4). SIERRA LEONE. **Report on the forest administration of Sierra Leone for the year 1944.** Govt. Printer, Freetown. 1945. pp. 14. [1020].

05.3 (66.7). GOLD COAST. **Report on the Forestry Department for the year 1944–45.** Govt. Printing Department, Accra. 1945. pp. 7. [1021].

05.3 (67.6) : 23.24 : 98.1. UGANDA. **Forest Department: annual report for the year ended 31st December, 1944.** Govt. Printer, Uganda. 1945. pp. 8. [1022].

05.3 (68.9) : 34.25–6. NYASALAND. **Report of the Department of Agriculture for the year 1944. Part I. Agriculture in Nyasaland. Part II. Experimental work.** Govt. Printer, Zomba. [1945?] pp. 8 + 12. [1023].

05.3 (71). CANADA. **Report of the Lands, Parks and Forests Branch for the fiscal year ended March 31, 1944.** *Repr.* from Annual Report of the Department of Mines and Resources, Canada. 1945. pp. 61–107. [1024].

05.3 (729). STOCKDALE, SIR F. **Development and welfare in the West Indies, 1943–44.** H.M. Stationery Office, London. 1945. pp. 115. Colonial No. 189. [1025].

05.3 (729.2). JAMAICA. **Annual report: Forest Department, 1942–43.** Forest Department [Kingston], Jamaica. 1943. pp. 9. [1026].

05.3 (729.2). JAMAICA. **Annual report: Forest Department for year ended March 31st, 1945.** Forest Department [Kingston], Jamaica. 1945. pp. 9. [1027].

05.3 (932). FIJI. **Forest Department. (Annual report for 1944.)** *Council Paper* No. 9, 1945. pp. 4. [1028].

05.3 (96.9) : 23.24. HAWAII. **Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii for the biennial period ended December 31, 1944.** Board of Agriculture and Forestry, Territory of Hawaii. 1945. pp. 115. [1029].

07. EDUCATION AND RESEARCH

07.1 (94). **Report of the Commission on Higher Education in the Colonies.** H.M. Stationery Office, London. Cmd. 6647, 1945. pp. 119. [1030].

The commission was appointed in 1943 to conduct an enquiry and make recommendations under the following terms of reference:—'To consider the principles which should guide the promotion of higher education, learning and research and the development of universities in the Colonies; and to explore means whereby universities and other appropriate bodies in the United Kingdom may be able to co-operate with institutions of higher education in the Colonies in order to give effect to these principles'. There are chapters on training for medicine, law, teaching, agriculture and veterinary science, but no mention of forestry.

07.2 (485) : 12.11.3 : 52.43.4–5. SWEDEN. Redogörelser för verksamheten vid Statens Skogsförsöksanstalt under åren 1941–44. [**Report on the work of the State Institute of Experimental Forestry during the years 1941–44.**] *Medd. Skogsförsöksanst. Stockh.* 34, 1945. pp. 417–50. [Sw.] C.G.B. [1031].

The 1941 Report states:

Following the advance in statistical methods, the new silvicultural production studies are to be based not, as hitherto, on established sample areas under observation for many decades, but on single observations of any sample plots where representative sample trees can be felled. The increment will be measured by a boring instead of diameter measurements extending over five years.

Olaf Langlet continued his genetical studies, including the inheritance of physiological

differences between Pine of different provenances, work on winter coloration in Pine, and the reaction of the crown in this species to various types of external interference.

The 1942 report states:

Observations on production were continued. Petrini completed his investigation on the Institute's Oak plantations and issued his report on the Swedish series of trials in the 1907 international investigation on Pine provenance.

The geobotanical survey of Västerbotten has been completed.

In connexion with Olaf Langlet's research on problems of races of forest trees, Pine and Spruce of various provenance have been planted in two localities.

The 1943 report states:

The routine production investigations in 1942 were extended and a study was made of (1) timber qualities that are characteristic of racial types, and (2) how far quality depends on race. The Association for Forest Tree Breeding has co-operated in selecting and describing typical specimens from which samples of wood are taken.

In collaboration with the State Boards for Demesnes and for Forests, the germination capacity of Norrland conifer seed, as well as cone production of, and quality of seed from, residual Spruce was studied by Tirén.

O. Langlet carried on his studies of races and relevant physiological problems.

The 1944 report states:

Reorganization of the Forestry Research Institute was undertaken, involving some changes in the scope of its research divisions and the appointment of staff. A statistical division was created.

Work proceeded on the germination capacity of conifer seed; a method of sampling seed was also evolved, and the results of analyses of germination were published by Tirén as a guide for cone collection in 1944–45.

The findings from a Spruce provenance experiment should be ready for publication in 1945.

O. Langlet continued his work on forest tree races and in some districts inspected Pine and Spruce of different provenance.

07.2 (73) : 34.6. ELLSWORTH, H. **Need of forest research.** *W. Cst. Lumberm.* 72 (6), 1945 (92, 94). [1032].

As an illustration of the need of further large-scale research in wood utilization in the United States, it is pointed out that more than 600 million acres of land are classified as forest and that only 30 per cent. of the wood fibre produced is actually utilized, the remaining 70 per cent. consisting of sawdust, slabs, edgings, trimmings which become waste at the mill, and the limbs, tops and cull logs which are left in the forest. The lumber manufacturing industry is made up of 38,895 individual units, most of them too small to undertake much, if anything, in the way of research. The trade associations, notably the National Lumber Manufacturers Association, have embarked on a considerable programme of research, but this is only a fraction of the work that is needed. It is urged that if the research programme is even to keep up the amount of work carried on during the past two years, the appropriation for forest research by the U.S. Forest Service should be increased by 1½ million dollars.

09.2. *Pre-history*

09.2 : 12.26–8 : 43. RAWITSCHER, F. **The Hazel period in the post-glacial development of forests.** *Nature, Lond.* 156, 1945 (302–3). [Department of Botany, Univ. of São Paulo.] [1033].

Pollen analysis shows a Hazel maximum in many horizons, especially in Central and Western Europe. This Hazel period has been assigned to the beginning of the post-glacial warm period and coincides with the mesolithic culture period. Climatic changes, such as those in humidity, were apparently not very important, according to determination of widths of annual rings in charcoal from prehistoric sites [cf. *For. Abstr.* 2 (181)]. The writer suggests that the cause of this great extension of Hazel may have been the use of fire to clear land for cultivation [cf. *For. Abstr.* 7 (No. 531)]. *Corylus* species are very fire-resistant, and Hazel scrub quickly springs up in burned-over woodland. There is a certain correlation in maps of the distribution of the Hazel maximum, and the distribution of the Campignien (mesolithic) culture in Europe.

09.2 : 12.26–8 (54.6). PURI, G. S. **Some fossil leaves of *Litsaea lanuginosa* Nees. from the Karewa beds at Liddarmarg, Pir Panjal, Kashmir.** *J. Indian bot. Soc.* 24, 1945 (95–100 + plate). [Univ. of Lucknow.] O.B.D. [1034].

The paper describes fossil leaves of *Litsaea lanuginosa*, a tropical species at present found scattered in the outer Himalayan ranges from Kashmir to Sikkim. The three fossil specimens were discovered near Liddarmarg, at an altitude of 10,600 ft., in the Pir Panjal Range, Kashmir, in 1910. The living species does not now grow anywhere in Kashmir, except at Muzzaffarabad at an altitude of 4,000 ft. It is also absent from the neighbouring regions, including the Pir Panjal Range. The contrast between the past and present distribution of the species in Kashmir furnishes further data in favour of the theory of the Pleistocene uplift of the Himalayas. The fossils were previously wrongly identified as *Cinnamomum tamala*.

09.2 : 12.26–8 (54.6). PURI, G. S. **Some fossil leaflets of *Aesculus indica* Colebr. from the Karewa beds at Laredura and Ningal Nullah, Pir Panjal, Kashmir.** *J. Indian bot. Soc.* 24, 1945 (149–51 + plate). [Univ. of Lucknow.] O.B.D. [1035].

Some leaflets of *Aesculus indica* collected by the author from the Lower Karewa deposits (Pleistocene), at Laredura (altitude 6,000 ft.) and Ningal Nullah (altitude 9,000 ft.) are described in detail. The modern distribution of the genus and of the fossil species is given with special reference to India. The living species is still found quite close to the fossiliferous localities.

The plants associated with the fossil species at Laredura and Ningal Nullah are quite different. Although the Ningal Nullah associates of the species still exist in the Kashmir Valley, most of the plants associated with the Indian Horse-chestnut at Laredura during the Pleistocene period have now disappeared from the valley proper and from the northern slopes of the Pir Panjal Range. *From author's summary.*

09.2 : 12.19.2 (57). NEYSHTADT, M. I. Eshche k voprosu o pervichnosti listvennichno-sosnovoy taigi v vostochnoy Sibiri. **[Further contribution to the question of the primeval character of the Larch/Pine forest in eastern Siberia.]** *Sovetsk. Bot.* No. 4/5, 1944 (71–6). [Russ.] O.B.D. [1036].

Pollen analysis of peat from near Takhtamygda, in the Amur region, showed remarkably little variation in the percentage of pollen of *Pinus sylvestris*, *Larix dahurica* and *Betula* sp. throughout the 2-metre depth of the sample.

Pine pollen varied between 53 and 68 per cent. and Larch pollen between 15 and 27 (with one sample showing 39) per cent. Below 1 m., Birch pollen, like that of *Pinus cembra*, *Abies*, *Picea*, *Salix* and *Alnus*, never exceeded 6 per cent.; but above this level Birch rose to 10–11 per cent. Thus, the forest would appear to have remained substantially the same for 3–4 thousand years. The present forest consists chiefly of Larch, with Pine dominating locally.

It is believed that no major climatic change occurred during the whole period, as other species grow sufficiently near to have invaded the region if the climate had been more favourable. Peat samples from the Irkutsk and Yakutsk regions, though somewhat more variable than that from the Amur region, confirm the primeval nature of Larch/Pine forest with Birch.

09.2 (74.2). KRAUSS, R. W., and KENT, G. N. **Analyses and correlation of four New Hampshire bogs.** *Ohio J. Sci.* 44, 1944 (11–7). [Oberlin College, Oberlin, Ohio.] L.S. [1037].

This paper attempts to correlate data from four New England bogs situated in the south-eastern part of New Hampshire with similar data from a number of other bogs along the Atlantic Coast. After giving an account of the profile studies, the authors briefly discuss the meteorological corroboration for the shifts of climate indicated in the profiles.

09.2 (75) : 12.26–8. BROWN, R. W. **Temperate species in the Eocene flora of the southeastern United States.** *J. Wash. Acad. Sci.* 34, 1944 (349–51). L.S. [1038].

Although temperate species occur relatively seldom in the Eocene flora of the United States, certain fossil plants characteristic of temperate conditions have nevertheless been found. These species may have originated inland from the coast, possibly along streams in the foothills of the Eocene Appalachians. Three such comparatively rare specimens are briefly discussed in this paper: *Fagus aspera* (Berry) Brown, n. comb., *Sassafras suspectum* Brown, n.sp., and *Staphylea splendens* (Berry) Brown, n.comb.

09.7. *Monographs of Individual Forest Regions*

09.7 (42.1–8) : 45.12. WARD, T. D. U. **Savernake forest.** *Wood* 10, 1945 (237–9). [1039].

Savernake Forest consists of more than 3,000 acres, mainly of hardwoods, and was leased to the Forestry Commission in 1938–9 for a period of 999 years. The lease contains a stipulation that the general character of the forest shall not be changed, and the erection of fences is strictly controlled. Natural seedlings under the Beech trees in some places amount to 400,000 to the acre but, on account of deer, rabbits and squirrels, few are likely to survive.

Since 1939 some 231 acres have been planted with hardwoods and 166 acres with conifers. Special attention is paid to amenity, and roads have been planted with Red Oak, Tulip Tree, Cherries, *Robinia pseudoacacia* and *Ailanthus glandulosa*. There are 19 acres of nurseries, in which the grey squirrel is a serious pest. Some seed-beds are covered with wire netting and acorns coated with red lead before they are sown, but the squirrels extract the acorns through the netting, remove the husk and eat the rest.

09.7 (42.1–8) : 12.26–8. **Sherwood Forest.** *Wood* 10, 1945 (275–7). [1040].

It is believed that the Forest of Sherwood covered some 100,000 acres in the 13th century. The only existing compact areas of the old forest now cover about 1,500 acres, mostly of very old Oaks, but with numerous plots of timber planted within the last century. Comparison between the old Oak woods of spontaneous origin and those planted in the same area raises the interesting problem, why should the old forest trees have attained great size while so many of the Oaks raised since 1800 are dying off before they reach maturity. No satisfactory answer to this question has yet been found.

09.7 (47.4) : 09.4 : 91. VOITK, E. J. Några glimtar från Estlands skogar. **[Some glimpses from Estonia's forests.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (423–7). [Sw.] [1041].

Estonia had 925,764 ha. of forest (21 per cent. of the total land area), of which 79 per cent. was State and 21 per cent. private forest. The chief species is Pine, closely followed by Spruce, which gives higher yields. Birch, Aspen, Grey Alder and Ash are the commonest hardwoods. The two last-named species yielded only fuelwood. Until the discovery of shale oil in 1918, wood was the only native fuel of importance; since then pulp manufacture has become the most important wood-using industry, but an extensive plywood and furniture industry has also developed, Birch being the main species used for these purposes. Along the coast, Pine was the basis of a boat-building industry. The average volume increment of the forests was 3 per cent. In 1938 the cut was rather more than 2 million cu. m., of which 20 per cent. was from private forests. Income from State forests was only 5 per cent. of the total revenue. Private forests yielded less than State Forests, as, until the foundation of the republic, all forest belonged to large estate owners and the new peasant owners were reluctant to cut, though forest grazing was practised and Spruce, in particular, suffered from cattle trampling. The splitting-up of the large estates created 40,000 new farms and a strong demand for timber to build farmhouses. Agriculture has since expanded, chiefly at the expense of swampy and other less valuable forest land, with State aid for drainage and the erection of buildings. Much forest land has also been improved by drainage.

09.7 (51). NORD, E. C. **A glimpse of free China.** *J. For.* 43, 1945 (640–1). [1042].

The forests of China have been very generally depleted by overcutting and burning. Such trees as are accessible from the roads and manage to grow beyond sapling size are weakened and deformed by indiscriminate lopping; the smaller branches and twigs are made into charcoal, while leaves and needles are moulded into balls and used as fuel.

A vast resource of grazing land is available in the mountains, but is not used to any extent. Since practically none of the vegetative growth is utilized or cropped, it offers a big fire hazard during winter and early spring, and reproduction of trees is greatly reduced. Extension of grazing would reduce fire hazard and so increase forest cover which is needed both for timber and fuel and for checking erosion.

09.7 (54.9) : 12.19.2 : 33. VAHID, S. A. **Forests of Hyderabad Deccan.** *Abstr.* in *Indian For.* 71, 1945 (236). [Osmania Univ.] [1043].

The State forests occupy an area of 9,357 sq. miles (11·3 per cent. of the total land area). The three divisions of the forest (i) Godavari valley, (ii) Krishna basin and (iii) the north-west forests, are described. They comprise three distinct types: (*a*) mixed Teak on slopes, (*b*)

mixed Teak on plains and (*c*) *Hardwickia binata*. A special type with Sandal as the dominant species is found in the north-west. A fourfold classification of the forests from the point of view of their utility is given in detail. The inadequacy of the forest area for the needs of the country is illustrated by comparison with other Indian Provinces and European countries.

09.7 (59.1) : 09.1 : 12.19.2 : 94 : 32 : 12.26–8. MOREHEAD, F. T. **The forests of Burma.** *Burma Pamphlets* No. 5, 1944. pp. 67 + plates + map. [Longmans, Green & Co., Ltd., London.] [1044].

A condensed account of the essential facts about the forests of Burma, their organization and exploitation. The subject matter includes topography and climate; forest types classified according to Troup's *Silviculture of Indian Trees*; forest fauna, and particularly the life history of the elephant (in 1942 there were 6,000 tame and 5,000 wild elephants); a history of the development of forestry, administration, policy, legislation, organization, research, etc.; exploitation by Government agency and by lessees (which is virtually the history of the five big Teak lessees, some of whom were working Teak nearly a hundred years ago); methods of extraction, uses and markets; and minor forest products. The average annual royalty collected on all forest produce just before the Japanese occupation was about £1,140,000.

09.7 (77.1) : 12.19.2 : 97.2 : 98.1. GYSEL, L. W. **The forest resources of Auglaize County, Ohio.** *Ohio J. Sci.* 44, 1944 (103–22). [Agricultural Exp. Sta., Wooster, Ohio.] L.S. [1045].

Auglaize County is a mainly agricultural unit in which the woodlands are of secondary importance. Originally, however, this region was almost entirely covered with swamp forests. Cutting, grazing, and drainage are the most important factors which have brought about the woodland conditions of to-day.

Only 6·3 per cent. of the total area of the county is now forested. The woodlands, which are usually a section of a farm, are generally small units, the average size of which is 10·9 acres. Of the total woodland area, only 5·4 per cent. is comparable to the original stands in composition and structure. Severe cutting characterizes a large number of the woodlands, as shown by the fact that 34 per cent. of the total forested area is composed of young growth with a few scattered large trees, and 17 per cent. is open park grazed stands.

For the county as a whole, the Oaks as a group are the most important vegetation in the woodlands in regard to value and cover. However, one of the most noticeable observations made in this survey was that there is only a small number of trees of this genus in the reproduction of all types. The important individual tree species according to the total number of stems and total basal area are the American Elm and Shagbark Hickory. Both species are present in all types and are generally dominant in the reproduction. Sugar Maple and White Ash are valuable species which also occur throughout the county.

The values of the forest products and of the wood-using industries are important economic factors in the county. For the average farm, fuelwood is the most important woodland product. *From author's summary.*

09.7 (86) : 12.19.1. ACOSTA SOLIS, M. Nuevas contribuciones al conocimiento de la provincia de Esmeraldas. I. **[New contributions to the knowledge of the Province of Esmeraldas. I.]** Quito, Ecuador. 1944. pp. 606 + plates. *Abstr.* in *Trop. Woods* No. 83, 1945 (22). [1046].

The botanical material has been largely reserved for publication in a second paper, and the present work deals with the vegetation of Esmeraldas only in one chapter where the principal forest species of the province are enumerated. The subjects taken up in detail include: geography, climatology, fauna, insects, agriculture, archaeology, the Capaya Indians, educational problems, and commerce.

09.7 (91.1) : 98.1 : 34. HOPKINS, A. G. **Borneo —El Dorado of the southwest Pacific.** *Foreign Comm. Wkly.* 19 (13), 1945 (3–7, 40–1). [U.S. Bureau of Foreign and Domestic Commerce.] I.F.B. [1047].

Eighty per cent. of the area of Borneo is covered by forest composed of several hundreds of species. Amongst the valuable hardwoods are Billian or Borneo Ironwood [*Eusideroxylon zwageri*], Borneo Teak [*Afzelia bijuga*], and Sandalwood [*Santalum album*]. Many of the trees are 150 to 200 ft. high and yield lumber of exceptional dimensions. The Kalandang [? *Artocarpus lanceaefolia*] frequently reaches 220 ft. with a clear trunk of 95 to 125 ft. Borneo Cedar [*Shorea* spp.] can be had in

lengths of 80 ft., Ironwood in lengths of 100 ft., and Camphor [*Dryobalanops aromatica*] 60 ft. or more. Contrary to the usual state of things in tropical forest, many species in Borneo occur in pure stands, making their remunerative exploitation possible. The Netherlands East Indies Government made a survey of forest resources in 1937 and discovered near Sampit an almost pure stand of Pine [*Pinus merkusii*] covering 37,000 acres and containing an estimated 54 million cu. ft. of timber considered suitable for the manufacture of container plywood, pulp and paper. Ironwood stands covering 124,000 acres on the island of Pulu Laut and estimated to contain 35 million cu. ft. were discovered during the same survey.

The minor forest products such as tannin (from Mangrove bark), various resins, gutta-percha, rattan canes, Palm fibre, oil, copra, etc., are abundant and valuable.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.2. *Climate*

11.2 : 11.1 : 91.3. LUCHSHEV, A. A., and PETROVSKI, Yu. S. Dannȳe po meteorologicheskomu rezhimu v lesnȳkh nasazhdeniyakh. **[Data on the meteorological regime of forest stands.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (95–124 + dgms.). [Russ.] [1048].

The influence of the forest on microclimate was clearly evident in the dense (0·7–0·9) coniferous stands at the Istrinsk and Oksk forest stations, where the observations were made.

Temperature:—In the winter there was practically no difference between the average air temperature in the forest and that in the field. At the start of thawing the air temperature in the forest began to fall lower than that in the field; this difference reached its peak in April, when the temperature of the air in the forest was directly influenced by the persistence of the snow cover, which by that time had completely disappeared from the open areas. The difference between the air temperature in the forest and that of the field diminished as the snow disappeared, and no longer existed in May. During the period of thaw the vertical distribution of air temperature in the forest was significantly different from that in the field: in the forest, during the day, the temperature of the air layers at the ground surface was much lower than at 2 m., but this was not so in the field.

With the beginning of summer, air temperatures in the field again began to exceed those of the forest. During the hot and dry period from mid-July to mid-September the average temperature in the forest was 1·8° lower than in the field, and sometimes as much as 5°. Air temperatures in the forest were always lower than in the field. From the second half of September the difference between the forest and field temperatures began to diminish and by the end of October there was again practically no difference.

Humidity:—There was no difference between the air humidity in the forest and that in the field during the winter. In April the air humidity in the forest began to rise above that in the field; in the summer months, especially during the dry and hot period, when the mean relative humidity in the field was about 50 per cent., that under coniferous cover was 15–20 per cent. higher, and the forest reduced the humidity deficit by 3–4 mm. During some hours of the day, atmospheric humidity in the forest was 25–28 per cent. higher than in the field. In September, owing to a sharp rise of relative humidity in the field, the difference decreased, and later in the autumn it became very slight.

Evaporation:—Wild's evaporimeter was used. The loss of water from the accumulated winter precipitation (snow) by evaporation during the period of thaw may be as much as 44 per cent. Field lost far more water through evaporation than the forest, especially coniferous forest. Evaporation from the surface of the snow in the coniferous forest was one-third of that in the field, and even towards the end of the thaw period (13–22 April), when the temperature was fairly high, evaporation in the forest did not exceed an average of 0·2 mm. per day. Therefore, in spite of the fact that the store of snow in the coniferous forest was smaller than in the field, the difference was more than balanced by the lower rate of evaporation in the former.

Precipitation:—Hydrological conditions in 1937–38 were unusual. Snowfalls during the winter were frequent and exceptionally heavy,

and, owing to the absence of strong winds, the canopy of coniferous forests accumulated a great deal of snow. There were only a few falls of rain during the summer, and practically none in July and August. The amount of precipitation intercepted by various stands depended directly on their density, but of the total winter precipitation—247 mm. (from November to March) in the Istrinsk area, a 50-year-old Aspen stand of density 0·8 intercepted in all 12 mm. or 5 per cent.; Aspen, 50-year-old, with a second storey of Spruce and a density of 1·0, intercepted 20 mm. or 8 per cent.; while pure Spruce, aged 55 years and of density 0·9, intercepted 59 mm. or 24 per cent. A Pine stand at the Oksk forest station, aged 90 years and of density 0·8, intercepted 15 per cent. of the winter precipitation.

The amounts of precipitation intercepted by the various stands remained on the whole the same during the summer months, except for the broadleaved stands, which naturally showed increased interception. With heavy rain the percentage of precipitation intercepted by the crowns decreased. Five mm. was the limit of interception of liquid precipitation by Spruce crowns in the summer, and 3 mm. during the autumn.

Spells of drought preceding the rain had no influence on the quantity of precipitation intercepted, e.g. at the Istrinsk forest station after 1½ months of hot and dry weather there was a light fall of 2·1 mm. of which a Spruce stand intercepted 1·2 mm. or 57 per cent., Aspen 0·6 mm. or 28 per cent. and a mixed stand 1·3 mm. or 62 per cent. The next rain was 4 hours later and amounted to 3·8 mm. of which the Spruce stand intercepted 1·5 mm. or 39 per cent., Aspen 0·8 mm. or 21 per cent. and the mixed stand 1·4 mm. or 37 per cent. Both sets of figures are normal for the amounts of rain in question.

Wind:—Average monthly wind velocity at a height of 2 m., both in Pine and in Spruce forests did not exceed 0·3 m. per sec. During the period of thaw, the average wind velocity in the forest was about one-ninth to one-tenth of that in the field: from April 1st to 15th the average wind velocity was 0·3 m. per sec. in Pine forest (Oksk) and 2·9 m. per sec. in the field; from March 11th to April 21st the average wind velocity was 0·5 m. per sec. in Spruce forest (Istrinsk) and 4·4 m. per sec. in the field.

11.4. *Soil*

11.4 (485) : 12.19.2 : 11.2 : 11.11. TAMM, O. Den nordsvenska skogsmarken. En kortfattad, populär översikt av de företeelser, som betinga skogsmarkens produktionsförmåga. [**The forest land of northern Sweden. A short, popular review of the factors that determine the productive capacity of forest land.**] Norrlands Skogsvårdsförbunds Förlag. Stockholm. 1940. pp. 285. [Sw.] [1049].

An illustrated semi-popular account, with chapters on:—general demands of the forest on the site; the North Swedish forest communities; climatic conditions influencing the forest; mineral constituents; review of the chief mineral soil types (moraines, water and wind sediments); geological formations of Northern Sweden; organic constituents, humus; soil formation, weathering, climatic soil regions; causes of variations in the process of podzolization, profile variants; ground and soil water; temperature relations, phenomena of freezing; different forms of mull and raw humus and their significance to the forest; distribution of North Swedish forest communities and their stability or otherwise; site quality (productivity) and its permanence; points of view on the practical classification of forest land. There is a subject index.

11.41. Soil Physics

11.41 : 11.42 (54.87) : 12.19. JOACHIM, A. W. R., and KANDIAH, S. **Studies on Ceylon soils. XVI. The chemical and physical characteristics of the soils of adjacent contrasting vegetation formations.** *Trop. Agriculturist, Ceylon* 98 (2), 1942 (15–30 + plates). [1050].

Attention is directed to the existence of a distinct community (grassland, fernland or parkland) side by side with or in close vicinity to jungle or forest in the different climatic zones of Ceylon, and the theories accounting for this phenomenon are reviewed and discussed.

A comparative study of the morphological and analytical characteristics of fourteen soil profiles sited in these contrasting vegetation formations has revealed that the upper horizons of grassland (patana) soils are markedly lower in exchangeable-base contents, and, therefore, more acidic in reaction than those of the

adjacent forest soils. Their carbon and nitrogen contents are also lower, and the organic matter itself is less humified. The patana top soil has a higher moisture-holding capacity, pore space, sticky-point moisture, moisture equivalent and percolation rate than the corresponding forest soil. The C horizons (sub-soils) of both vegetation soil types are very similar in physical and chemical composition, but the drainage of the patana sub-soils tends to be somewhat impeded.

There are no appreciable differences between the soils and sub-soils of the fernlands and those of the contiguous forest. Such differences as exist have arisen as a result of conditions favouring an accumulation of acid humic material under fernland conditions. There is evidence for the view that the patanas and the fernlands are an ecological succession to forest, the transformation having been effected by the periodical burning of the secondary vegetation.

The soils of the parklands, though much shallower are of the same fundamental nature as the jungle soils in the vicinity. They have, however, slightly lower carbon and nitrogen content and much higher exchangeable magnesium/calcium ratios than the latter soils. Their water percolation rate is lower than those of the jungle soils, and their natural drainage is, therefore, imperfect. These soils set very hard on drying. The occasional burning of the grasses in parkland areas contributes in some measure to the permanence of this vegetative formation. *From authors' summary.*

11.43. Biology of Soil, including Mycorrhiza

11.43.1 : 12.21 : 11.47 : 21.3. RAYNER, M. C. **Trees and toadstools.** Faber and Faber Ltd., 24 Russell Square, London. 1945. pp. 71 + plates. Price 6*s*. [1051].

Although designed to interest the non-scientific reader in the relationship between trees and toadstools the book is, in fact, a lucid and technically accurate account of woodland fungi and how their life histories fit in with those of green plants and the microflora and microfauna of the soil in the nitrogen cycle. The fungus roots (mycorrhizas) of trees are described and depicted in a story of their discovery and interpretation which emphasizes how pure culture of the fungus and the host-tree seedling has supplied the final proof of the identity of root fungi. There is now much accurate information about the root fungi of Scots and other Pines, Norway Spruce, Larch, Birch, etc.; many of these mycorrhiza-formers fructify in the form of toadstools and many species are known to have a very wide geographical distribution. A final chapter deals with plant partnerships and the kind of symbiosis represented in mycorrhizal associations, with the conclusion, among others, that normal, healthy and vigorous growth of trees follows upon and is directly related to the free development of mycorrhizas. The practical value of this research to forestry, especially in nurseries and afforestation areas on soils from which the appropriate woodland fungi are absent, has been shown in different parts of the world by the successful results of introducing into the soil, humus containing the desired mycelium. The author concludes with a discussion of auxins, ecological stability in the soil and penicillin.

11.43.1 : 12.26–8 : 12.21. DEMOLON, A, and DUNEZ, A Observations sur le mécanisme de la symbiose bactérienne chez les Légumineuses. **[Observations on the mechanism of bacterial symbiosis in the Leguminosae.]** *C.R. Acad. Sci., Paris* 216, 1943 (312–3). [F.] L.S. [1052].

The formation of NH_3 in the nodules of leguminous plants is closely related to the respiration of the root tissues. The process is not, however, accompanied by any appreciable increase in the amount of CO_2 given off by the tissues. Maximum intensity is reached during the period of active growth of the plant. The amount of NH_3 given off by the same leguminous species is considerably less in depleted than in healthy soils, and in the former the process is accompanied by gradual degeneration of the bacteroids. Experiments confirm the necessity for the presence of gaseous nitrogen and a certain proportion of oxygen for the production of NH_3 by the root nodules. The influence of certain other substances, such as chloroform, toluene, yeast extract and an alkaline nitrate, on the process of ammonia formation is also indicated. Results tend to show that the enzymatic process of fixation is determined by the nitrogenous nutrition of the microbes. The symbiotic fixation of atmospheric nitrogen appears to be a phenomenon bound up with the development of *B[acillus] radicicola* in the cytoplasm and with conditions

resulting from cellular metabolism. All fixation ceases in the presence of nitrates or when respiration is artificially suspended. On the other hand, symbiosis does not entail any noticeable variation in the quantity of CO_2 given off by the root tissues. It therefore results in only a slight accumulation of glucides.

11.43.2 (729.7). STRICKLAND, A. H. **A survey of the arthropod soil and litter fauna of some forest reserves and cacao estates in Trinidad, British West Indies.** *J. Anim. Ecol.* 14, 1945 (1–11). [1053].

An apparatus for the flotation-extraction of arthropod fauna from soil samples is described, and the sampling and extraction techniques used in the present investigation are shown to be sufficiently accurate for preliminary work on the gross arthropod fauna of soil and surface litter. The ecological environment would seem to have a greater influence on the magnitude of the arthropod soil population than the gross soil type although the latter undoubtedly has a considerable influence on the type of arthropods inhabiting it. Distribution in depth falls off very rapidly after the first 2 or 3 in. Many forms do not seem to migrate deeper than 6 in. from the soil surface, and only mites and ants appear to occur in any numbers at the 9-in. level.

The occurrence of coccids and their attendant ants, in relatively large numbers, especially on two estates where the general yield of cacao has decreased rapidly in the last few years, shows that at least one group of soil insects is probably doing economic damage to a plantation crop in Trinidad.

11.44. Surface Humus

11.44 : 11.47.2 : 12.25 : 12.14.5. CHANDLER, R. F. **Amount and mineral nutrient content of freshly fallen needle litter of some northeastern conifers.** *Proc. Soil Sci. Soc. Amer. 1943* 8, 1944 (409–11). [Cornell Univ., Ithaca, N.Y.] L.S. [1054].

A study was made of the annual leaf-litter deposition from Red and White Pine (*Pinus resinosa* and *P. strobus*), Red and Norway Spruce (*Picea rubra* and *P. abies*), Hemlock (*Tsuga canadensis*), White Cedar (*Thuja occidentalis*) and Balsam Fir (*Abies balsamea*), the litter samples being analysed for calcium, magnesium, potassium, phosphorus, and nitrogen. From the results obtained it is concluded that:—

(i) The average annual litter fall (needles only) was 2,463 lb. per acre of oven-dry material.

(ii) The nutrient content of the litter varied as follows:—calcium, from 0·58 per cent. for Red Pine to 2·16 per cent. for White Cedar; nitrogen, from 0·60 per cent. for White Cedar to 1·25 per cent. for Balsam Fir; potassium, from 0·12 per cent. for Balsam Fir to 0·39 per cent. for Norway Spruce; magnesium, from 0·14 per cent. for Hemlock to 0·21 per cent. for White Pine; phosphorus, from 0·04 per cent. for White Cedar to 0·10 per cent. for Red Spruce.

(iii) The average total amounts of nutrients returned annually to an acre of ground, expressed in lb. per acre, were as follows: calcium, 26·5; nitrogen, 23·6; potassium, 6·5; magnesium, 4·5; and phosphorus, 1·8.

11.49. Soil Types

11.49.5 (41.1–4). FRASER, G. K. **Peat deposits of Scotland. Part I. General account.** *Wartime Pamph. geol. Surv. D.S.I.R.* No. 36, 1943. pp. 55. [Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen.] [1055].

This pamphlet is the first of a series designed to describe the larger and more accessible peat areas of Scotland. It is intended to serve as an introduction to the subject, and provides a general account of the peat deposits and peat types, their vegetational character, physical properties and chemical composition, together with a statement of their actual and potential uses. There is a bibliography of 93 references.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

11.62 : 11.41.5–6 : 11.41.3. DREIBELBIS, F. R., and POST, F. A. **Some seasonal changes in the pore space and moisture relationships of woodland, pasture, and cultivated soils.** *Proc. Soil Sci. Soc. Amer. 1943* 8, 1944 (102–8). [Soil Conservation Service, Coshocton, Ohio.] L.S. [1056].

In order to obtain information to assist in evaluating the effects of land use on soil and water conservation, volumes of solids, water, and air in soils from four watersheds representing woodland, pasture and two cultivated areas were determined at monthly intervals from August 1939 to July 1940. Pore-size

distribution data were also obtained from three profile layers of soils from these areas.

The results provide information on the potential infiltration and transmission capacity of the soil, and also indicate the amount of water that may be stored under average conditions throughout the profile at monthly intervals during the year as well as the storage opportunity remaining.

Hydrographs for run-off from a single storm are given for all watersheds studied except the woodland, where no run-off occurred. *From authors' summary.*

11.62 : 11.41.8 : 11.41.5–6. HURSH, C. R. **Water storage limitations in forest soil profiles.** *Proc. Soil Sci. Soc. Amer. 1943* 8, 1944 (412–4). [Appalachian Forest Exp. Sta., Asheville, N.C.] L.S. [1057].

Storm run-off of considerable magnitude will occur on forest land in mountain areas under conditions of high rainfall, thin soil and steep slopes; this is due to definite physical limitations in underground storage capacity. Thus, upper slopes of the southern Appalachian Mountains above 3,500 ft. may have 4 to 8 area inches less total storage opportunity than lower slopes or terrace lands in the same locality.

Eroded soil profiles of the southeastern Piedmont that have been abandoned after many years of clean cultivation may have less than one-third the macropore storage in the first 36 in. than is found in comparable soil types that have not been cleared for agriculture. Consequently, young Pine stands that invade badly eroded land do not have the initial water control and ground-water storage found in uncleared forest.

11.62 : 91.3. SMARAGDOV, D. G. Vodookhrannaya rol' lesa. **[The rôle of the forest in water conservation.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (5–26). [Russ.] [1058].

Introductory review of the papers contained in this volume.

11.62 : 11.14.4 : 65.1 : 65.7 : 91.3. MURASHEV, S. I., and KUZNETSOVA, Z. I. Vliyanie sostava, vozrasta i polnotȳ nasazhdeni na snegovoy rezhim. **[Influence of composition, age and density of stands on the snow régime.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (27–44). [Russ.] [1059].

Studies made in Moscow, Kalinin, Voronezh and Kuibyshev Provinces and the Tartar A.S.S.R., covering Spruce, Pine, and broadleaved stands differing in density, composition and age, showed that in these stands the reserve of snow calculated as water was equal to that in glades; in a few cases, however, it was as much as 17 per cent. less.

Thawing usually began in the stands at the same time as in the glades and lasted longest (28 days) in a pure Spruce stand (Moscow region; age 40–50 years; density 0·8–0·6).

In Spruce stands the snow loss calculated as equivalent water showed a mean daily rate of 2–8 mm. and a maximum daily rate of 5·5–10 mm. during the thaw, on some days reaching 21 mm. In the glades the rate of thaw was higher and the thaw was of shorter duration.

By lengthening the period of thaw and thus decreasing the rate of entry of water into the surface soil, Spruce stands increased the intake of moisture by the soil and subsoil and reduced the surface run-off.

The accumulation of snow in Pine stands before the thaw was mostly similar to that in Spruce. The mean daily rate of thaw in Pine stands varied from 2 to 8 mm., and the maximum daily rate from 3 to 16 mm.

The reserve of snow, in both Spruce and Pine stands, was smaller than in the fields, but the period of thaw was much longer under forest cover than in the open. The average duration of thawing in Pine stands fluctuated from 14 days (60 per cent. Pine; density 0·6; age 15 years) to 38 days (pure Pine; density 0·7; age 60 years). In most Pine and Spruce stands the duration of thaw was greater than in broadleaved stands. The longest thaws were observed in pure conifer stands of high density and age, and the shortest in young and low-density stands.

The duration of thaw in the open areas was 10 days shorter than in Pine stands, and 16 days shorter than in Spruce stands.

Under broadleaved cover, thawing took longest in a stand of 80 per cent. Aspen + 20 per cent. Birch (density 0·9, age 15) and lasted for 33 days whereas in glades the thaw period was 13 days.

11.62 : 11.44 : 11.41. SOZȲKIN, N. F. Gidrologicheskoe znachenie lesnoy podstilki i fizicheskikh svoystv lesnȳkh pochv. **[Hydrological significance of forest litter and the physical properties of forest soils.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (125–205). [Russ.] [1060].

A report on the results of research carried out by the soil science laboratories of VNIILKh, with a short review of literature (chiefly Russian).

Forest litter on the soil is of very great value; apart from its water-absorbing capacity, litter has other important effects upon the soil: preservation of high permeability; regulation of the temperature; reduction of evaporation and regularization of the soil-water reserves.

The water-absorbing capacity of forest soil with litter was 2–4 times as high as that of similar soil under cultivation. With rain of short duration, litter absorbed 5–7 mm. of precipitation. Water absorption decreased by types of cover in the order: sod with dead leaves; needle litter; 'green' mosses; sphagnum; lichens.

Forest soils were characterized by higher porosity, higher permeability to water, and greater water-absorbing capacity, compared with the soils on felled areas and agricultural lands.

The influence of forest was especially marked on heavy soils, where the root systems loosened the soil of the upper horizons. Suglinok soil under forest was capable of absorbing greater amounts of precipitation and spring run-off than a similar soil in open areas. The rate of intake of precipitation by the forest soil did not fall below 1 mm. per min. during the first half-hour.

With long, heavy rain (more than half-an-hour) surface run-off may possibly occur on forest suglinok soils.

Removal of the forest litter from permeable soils apparently increases evaporation within the soil.

11.62 : 91.3 : 12.11.14 (47.2). GOTSHALK, Yu. F. Dannȳe o gidrologicheskoy roli nasazhdenii v raione Trostyanetskoy lesnoy opȳtnoy stantsii. **[Data on the hydrological rôle of stands in the vicinity of the Trostyanetsk forest experiment station.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (229–52). [Russ.] [1061].

Brief account of various studies in the Trostyanetsk forest region, which lies at about 50° 27′ N. latitude and 4° 34′ E. of Pulkov (average annual precipitation 656 mm.; evaporation 665 mm.; botanical and geographical conditions similar to those of the eastern Oak pre-steppe zone of the Ukraine).

The influence of the forest on the water régime of the territory it occupies depends directly on the soil and geological substratum, surface gradient, configuration and surroundings of the given area. On the even plateau there is no surface run-off, and here soils under forest cannot receive additional moisture from outside. A normal forest on the slope intercepts surface run-off, the soil receives additional moisture, and, if there are favourably situated permeable layers, the forest increases the volume of ground water.

A shelterbelt type of woodland (from a few metres up to tens of metres in width) surrounded by open land has a different influence on the moisture content of the soil and subsoil from that of a similar strip within a block of forest. In the first case snowdrifts often accumulate and, in thawing, considerably increase soil and subsoil moisture and raise the ground-water level. In the second case there is no additional accumulation of snow and consequently no increase in the level of the ground water. Drifts along forest margins have the same effect in this respect as a shelterbelt.

Forest surrounding an open area (field or felled area) prevents the snow from blowing away, thereby increasing both moisture received by soil and subsoil and also the ground water.

The soil and the subsoil in field gullies contain considerably more moisture than those in forest gullies, as forest, by covering gullies, prevents drifting. Intensive cattle grazing on forested slopes prevents the forest soil from absorbing run-off, and considerable surface run-off from such areas may result.

Soil under forest freezes less deeply and for a shorter period than the field soil, owing to protection by (i) snow cover of longer duration and looser texture; (ii) forest litter; and (iii) forest canopy.

Forest prevents snow cover from being blown away and retards thawing; this is especially important in forested areas on a southern slope. Thaw run-off from the forest begins when the open areas are already completely free of the snow cover.

Soil under old natural forest has a very high permeability to water, many times exceeding that of field soil, including arable cropland. Cultivation of the forest soil decreases its permeability, which is only very slowly restored after reafforestation. Even moderate

cattle grazing on forest sites decreases their permeability by compacting the soil.

Out of the total moisture expended by an old wood of the moist Maple/Lime/Oak type, during the warm period of the year, about three-quarters was lost by transpiration: of the remaining quarter, two-thirds was lost by evaporation from the soil, and one-third by evaporation of intercepted precipitation from the surface of the forest.

On a sandy soil and subsoil, and on suglinok (sand and clay) soils, forest uses considerably greater amounts of moisture than herbaceous vegetation, and thus reduces both soil/subsoil moisture and ground water.

Young stands use less moisture than middle-aged ones. Apparently the curve of moisture expenditure runs parallel with that of current increment. The expenditure of moisture by a stand increases directly with its density.

Water losses by evaporation varied with species in decreasing order as follows:—Ash, Lime, common Elm, Oak. The incidence of maximum expenditure of moisture also varies with species but further research is needed on this point.

11.62.1 : 12.19.4 (79.2) : 45.11. COTTAM, W. P., and EVANS, F. R. **A comparative study of the vegetation of the grazed and ungrazed canyons of the Wasatch Range, Utah.** *Ecology* 26, 1945 (171–81). [Univ. of Utah, Salt Lake City, Utah.] [1062].

A study of two adjacent canyons, one of which has been protected for 40 years, while the other has been heavily grazed for 100 years, showed the danger of complete extermination of palatable species of grass and shrubs through over-grazing. Some highly palatable shrubs have a density in the grazed canyon of less than one-third that in the ungrazed, while shrubs of low palatability have a density 13 times as great as in the ungrazed canyon. Sheet erosion is general throughout the grazed canyon, and advanced gully erosion is common along a sheep trail.

11.62.1 (79.7) : 60.32. GRONDAL, B. L. **Relation of runoff and water quality to land and forest use in Cedar River watershed.** With editorial note. *J. Amer. Wat. Wks. Ass.* 37 (1), 1945 (15–20). [Univ. of Washington, Seattle, Wash.] L.S. [1063].

A commission was appointed by the city council of Seattle to study the catchment area of the Cedar River, from which the city obtains its water supplies, with the primary object of deciding future policies with respect to logging in the catchment area. The commission, which completed its field studies in January, 1944, recommended a continuation of logging on a controlled sustained-yield basis. This recommendation is based on various considerations which are outlined briefly in this paper and are concerned with such matters as soil porosity, snow storage, quality of water, pollution, revenue, employment and forest improvement.

11.62.1 : 91.3. TROITSKI, V. A., and ZHERNOVA, M. N. Vliyanie lesa na poverkhnostnȳ stok. **[The influence of the forest on surface run-off.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (45–93 + dgms.). [Russ.] [1064].

A comparative study was made of the surface run-off from forested, open and small catchment areas. The amount of water in the snow cover of the areas under observation was estimated before the beginning of thaw. Meteorological factors were measured during the whole year at special field and forest meteorological stations by self-recording instruments.

The areas under observation were:—(1 and 2) *Spruce stands* on suglinoks (age 41–60 years; site quality I–II; density 0·7–1·0) in the Istrinsk area, Moscow Province, and Goretsk area B.S.S.R., respectively.

(3) *Pine stand* on Oksk river sand dunes (age 61–80 years; site quality II; density 0·4–0·8) in the Oksk area, Moscow Province.

(4) *Oak stands* on degraded chernozem and dark-grey suglinok (age 81–100 years; site quality I; density 0·7–1·0) in the Shipov area, Voronezh Province.

(5) *Oak/Maple/Lime* on forest suglinok and chernozem (age 41–60 years; site quality I; density 1·0) on sloping terrain in the Mokhovsk area, Kursk Province.

(*a*) *Winter run-off*: Goretsk area—With temporary February thaws, starting simultaneously in field and forest, run-off ended on the field plots after 3 days and in the forest after 7 days, as under dense Spruce cover the drop in temperature after the return of cold weather lagged behind that in the field. Shipov area—During five winter thaws, run-off from forest was 0·97–44·6 per cent. of that from open areas. There was no winter surface run-off in the remaining areas.

(*b*) *Spring run-off*: (i) *Istrinsk* (*Spruce*)—Spring run-off from the forest plots began a month later, and from the forested catchments 4–19 days later, than from the field. The period of spring flow in forested basins was 10 days longer than in unforested ones. The coefficient of run-off from the field plots was 65 times that of the forest plots and 3 times that of catchment plots. The onset of maximum run-off from all forested areas was a month later than that on the open areas. The mean value for the maximum moduli of flow of the forested areas was $\frac{1}{8}$ of that for the open. (ii) *Goretsk* (*Spruce*)—Run-off began in the field and forest plots almost at the same time, though it lasted 6 days longer in the forest than in the field. The coefficients of run-off were 0·8 from open plots and 0·007 from forested plots. The rate of run-off in the forest was 400–500 times less than in the field. (iii) *Oksk* (*Pine*)—Owing to the sandy dune soil there was no surface flow either from forest or catchment plots. In the open areas, the average duration of surface flow was 3–7 days with a coefficient of flow of 0·02–0·06. (iv) *Shipov* (*Oak*)—Surface flow began almost simultaneously in the field and forest plots, and lasted 5 days in the forest, 8 days in the field plots, 9 days on the forested catchment, and 12 days on the open catchments. Surface run-off from the forested catchment ended 6 days later than that from the open catchment. The mean coefficient of run-off from field plots was 21 times that of forested plots, while the mean value for the forested catchment plots was about 7 times less than that of the field. (v) *Mokhovsk* (*Mixed broad-leaved stand on sloping ground*)—There was no surface run-off from the forested plots. The run-off from the field plots continued for 5 days and was completely absorbed on reaching the forest soil.

In all of the above-mentioned types of forest the spring run-off from the forested areas was many times smaller than that from the open areas, and, in general, the run-off in the forest started and ended later than in the field.

(*c*) *Summer run-off*: There was no summer run-off in the Istrinsk, Oksk and Shipov areas. In the Goretsk area it was insignificant; the coefficient of run-off was 0·4–1·6 per cent., increasing directly with increased intensity and duration of the rain.

The regulating rôle of the forests in retarding surface run-off and converting it into subsoil flow was clearly shown by all types of forests in the areas investigated.

11.62.11 : 11.62.3 : 91.3. KHARITONOV, G. A. Protivoerozionnaya rol' lesa v svyazi s zashchitoy rek ot zaileniya. [**Anti-erosive rôle of the forest in connexion with the protection of rivers from silt formation.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (207–28). [Russ.] [1065].

Studies were carried out on water catchments in the middle part of the Don basin (Shipov forest, southern forest steppe), and on catchments on the upper reaches of the Don and the Oka (Mokhov forest; central forest-steppe zone). The article is concerned chiefly with the soil-protective influence of the valley forests along the banks of the 'hydrographic network'.

(1) In the Shipov region two water catchments, forested and unforested, both fairly hilly, were under observation: (i) The forested catchment (301 ha.) was chiefly on degraded chernozem, dark-grey and grey forest soils; and was composed mainly of the forest types *Quercetum aegopodioso-caricosum-pilosae* (59 per cent.) and *Quercetum caricosum-pilosae* (34 per cent.), the bulk of the trees belonging to the age classes I–III. (ii) The unforested catchment (228 ha.) was agricultural land on ordinary and carbonate chernozems and eroded soils.

Run-off from the forested catchment contained hardly any heavy deposits, which during the spring period amounted to only 0·16 kg. per ha. The small amounts of suspended matter carried out of the forest are usually composed of organic material and are harmless as a component of silt.

The unforested catchment appeared to contribute the bulk of the heavy deposits in the river, which amounted to 462 kg. per ha. during the spring period. 99·5 per cent. of such heavy deposits was derived from bank erosion in the 'hydrographic network' and only 5 per cent. from erosion of arable watershed slopes. Silting depends more on the mechanical composition of the eroded matter than on its actual amount; thus the heavy fraction of the soil suspension, which is deposited as silt in the rivers, is composed of sand and sand-dust particles ($> 0{\cdot}01$), while the finer fractions ($< 0{\cdot}01$) tend to remain in suspension. It was shown that up to 84 per cent. of the suspended matter in the flow from arable watershed slopes consisted of fine earth and clay particles,

but after entering the 'hydrographic network' the suspension was augmented by the coarser products of bank erosion, the sand and sand-dust fraction (> 0·01) reaching 56 per cent. Thus it is considered imperative that the banks of the 'hydrographic network' should be afforested to prevent both bank erosion and river silting, whereas afforestation of the arable watershed slopes is much less important.

(2) The upper Don/Oka catchment (area 405 ha.) consisted of arable land with some pasture in the vicinity of the 'hydrographic network' and a very small proportion of forest (1·4 per cent.) near the confluence. The soils were of complex degraded chernozem and forest soil with loess-type suglinok subsoil. Topography was similar to that of the unforested Shipov catchment. Here the total heavy fraction of the soil suspension was considerably less than in the Shipov area but the content of coarse particles (> 0·01) was 71 per cent. and thus a greater potential source of silt. 97 per cent. of the heavy fraction was derived from bank erosion and only 3 per cent. from the arable watershed slopes.

Other general observations were as follows:— Though the herbaceous cover of banks in the 'hydrographic network' is incapable of detaining all the eroded material during downpours, the normal forest (undisturbed litter, normal density, absence of grazing animals) will completely absorb run-off from arable land and with it the eroded material, both of which increase the productivity of the forest.

A normal Oak forest was able to absorb completely even the maximum downpour run-off (15·7 litres per second per ha. for 51 minutes, with a suspension of 8 grams per litre). Forest litter is of great importance in that its irregular surface retards run-off; the absence or removal of litter considerably decreases the water-absorbing capacity of the soil and sedimentation, and heavy rain may erode forest soil bare of litter. Undergrowth, on the other hand, significantly affects neither sedimentation nor water-absorbing capacity, but is of value in fixing the forest soil and preventing erosion of the litter.

Where arable slopes adjoin forest on the banks of the 'hydrographic network', erosion is significantly slower than in the absence of such forest. Drifted snow at the forest margins acts as a filter for spring run-off from arable slopes. In some cases continual ploughing of the slopes results in the formation of a raised baulk along the edge of valley forests, thus diverting run-off from the forest, but often run-off accumulating in small depressions may break through into the forest, when the concentrated flow will erode both litter and forest soil. About 50 per cent. of the valley-forest area in the regions investigated was prevented by such obstructions from receiving surface run-off. It is recommended that to improve erosion control within the forest, plantations on the banks of the 'hydrographical network' should have trees planted along the contours and spaced closer in the rows than between them.

11.62.11 (54.5) : 38.8 : 96.5. GLOVER, SIR H. **Erosion in the Punjab: its causes and cure. A survey of soil conservation.** Superintendent, Govt. Printing, Lahore, Punjab. 1944. pp. ii + iii + 143 + 116 plates. [1066].

This comprehensive illustrated survey is divided into two parts. The first, which deals with the Punjab generally, has chapters on the country as a whole; soil, climate and vegetation; causes of erosion (with special reference to grazing); direct and indirect effects of erosion; duties of district officers; the cure for soil erosion (including total and rotational closure of forests); engineering works; forest policy and acts. The second part deals in more detail with the problems of soil erosion in each district, with an account of the remedial measures already carried out or in hand.

11.62.11 (54.5). GLOVER, SIR H. **Soil conservation in the Hoshiarpur District of the Punjab.** *Punjab For. Rec.* 1 (11), 1944. pp. 10 + ii + plates. [Forest Department, Lahore, Punjab.] [1067].

These notes on a tour in the Hoshiarpur District in 1943 summarize recent progress in the most advanced soil conservation charge in the Punjab. They amplify the pamphlet 'The Hoshiarpur Chos, their cause and cure', published in 1942.

11.62.11 (588):34.21.12.19.2:12.19.3. GLOVER, SIR H. **Soil erosion in Baluchistan.** *Emp. For. J.* 24, 1945 (21–32 + plates). [1068].

The writer toured Baluchistan in 1944 and submitted a report on soil erosion and forest conservancy. The forests lie mainly in the hills and occupy an area of 1,762 sq. miles out of a total land surface of 54,000 sq. miles. Most of the so-called forest is forest only in

name, is afforded only nominal protection, and is hardly distinguishable from the surrounding waste. Certain trees have been classed as 'reserved' and can be felled only with the permission of the Forest Officer. There are several main types of natural forest which have survived in especially favoured localities where they have been protected from sheep and goats.

(A) *Juniper forest.* Situated at 5,500 to 10,000 ft. above sea level are some 200 sq. miles of Juniper (*Juniperus macropoda*) forest, about half of which is demarcated. Between the Junipers are slow-grown dwarf Ash (*Fraxinus xanthoxyloides*), wild Almond (*Prunus eburnea*), wild Cherry (*Prunus cerasus*), while the ground is covered by a lower storey of bushes of *Caragana gerardiana, C. ambigua, Berberis vulgaris, Spiraea kabulica, Lonicera* sp., *Buddleia* sp. Trees, bushes, herbs and grasses are of isolated habit owing to the difficulty of obtaining moisture. Outside the demarcated forests the only control exercised is a partially effective ban on felling and lopping of Juniper. The forests are all heavily over-grazed.

(B) *The Olive (Olea cuspidata) forest.* No natural climax type of Olive forest was seen. Even before British occupation, the forests were heavily grazed and the Olive trees were pollarded, their leaves and branches being a favourite food of sheep, goats and camels. No seedlings were found, but occasional saplings occur among dense masses of dwarf palms. Olive trees persist from 4,000 to 6,000 ft. or higher; they are old, mutilated and generally mixed with *Pistacia khanjak* or *P. mutica.* At lower levels the Olive is mixed with Phulai (*Acacia modesta*) trees, which are generally of poor growth, but remarkably persistent, and manage occasionally to regenerate under the most adverse conditions. The soil is now far too dry for Olive seedlings to grow. Outside the reserves the forests no longer protect the soil and erosion is very bad indeed.

(C) *Spiny shrub and bush type.* From about 3,500 ft. downwards the country is very dry, and natural vegetation consists of xerophytic species such as *Periploca aphylla, Capparis aphylla, Zizyphus oxyphylla, Z. nummularia,* spiny repellent bushes, salsolaceous plants, thin grasses and minute herbs.

(D) *The upland-valley dry type.* The beds of the valleys and the lower slopes at about 4,000 to 6,000 ft. are covered with bushes of *Artemisia brevifolia, A. maritima, Acantholimon* and *Astragalus,* and dry types of grass. Lower down, *Haloxylon, Salsola* and other desert plants cover large areas of arid flats.

(E) *The flood-plain type.* In the stream beds on the naked silt appear *Tamarix annulata* and *T. dioica* bushes, which maintain a footing in spite of heavy grazing; where they have been protected, they sometimes grow well and form dense thickets with much fodder grass. There is no doubt that the flood plains would be well covered with vegetation were it not for the exceedingly heavy grazing.

(F) *The Chagai desert type.* Extending westwards from Nushki is a stony plateau at about 3,000 ft. where the rainfall is about 3 in. and the vegetation consists of scattered bushes which become fewer until the true desert is reached. Near Chandram aridity increases and there are large sand dunes which carry only a very scanty crop of xerophytic bushes. The main species are *Haloxylon ammodendron* (Taghaz), *Alligonum comosum, Astragalus* sp., *Pycnocycla aucheriana, Salsola arbuscula.* The Taghaz trees have all been coppiced, with shoots now up to 10 ft. in height. They are used for fuel and for making huts. The shoots appear from thick rootstocks up to 15 in. in diameter which are well over 200 years old. The roots run far into the soil, and the Taghaz tree performs a most useful service in fixing the sand dunes while other species, particularly the grasses (*Saccharum ciliare, Eragrostis* sp., and *Andropogon annulatus*), hold the surface of the dune in place. Excessive grazing destroys this surface vegetation and the sand drifts and is blown about by the wind. Recently the roots of the Taghaz trees have been dug up for fuel for Quetta and the cantonments. This tree should be strictly preserved, as, with its deep root system, developed over centuries, it serves to fix the sand dunes which will otherwise advance east. The grazing of sheep, goats and camels must be limited to what the natural vegetation can support, and the grazing must be rotational, in order to allow such vegetation as exists to recover.

Throughout the hills there has been very severe erosion of the soil; surface, gully and wind erosion all occur. The main cause of soil erosion is excessive and unregulated grazing; faulty methods of cultivation are the cause of much erosion in the Quetta-Pishin

district. The cure for soil erosion is the proper management of pastures. The limitation of flocks to the numbers which the vegetation can support, and rotational closure to grazing are the cures for avoidable erosion in the greater part of Baluchistan. The first task is to persuade the local people of the need for conserving vegetation; the second is to design the necessary measures and put them into force; the third is to regulate the use of pastures by migrants from outside.

11.62.11 (66.4) : 91. SIERRA LEONE. **Report on the forest administration of Sierra Leone for the year 1944.** Govt. Printer, Freetown. 1945. pp. 14. [1069].

The urgent necessity of arresting the destruction of forests and re-growth in hills was sharply emphasized by severe flooding. As legal processes of forest reservation are too slow and restrictive, Government approved the principle of Tribal Authorities issuing orders for soil conservation purposes, in conjunction with the local administrative, agricultural, and forest officers. The Tribal Authority declares the entire chiefdom a Soil Conservation Area and issues, as its first order, the prohibition of cutting and burning vegetation on hillsides above a *line* demarcated under its authority. By substituting a demarcated *line* for a surveyed and demarcated *closed area*, it is possible to work continuously in hilly regions with concurrent legal sanction as the field work progresses. The steep slopes and water-catchment areas are thus sealed off for the protection of the lowlands, which, under the same authority, can be brought under subsequent orders aiming at improved methods of conservative cultivation. In this way, rapid progress can be made in protecting hillsides, and this can be followed in due course by reservation when all factors for permanent land-utilization requirements have been surveyed and assessed (p. 2).

11.62.11 (67.5) : 97.1. GROOF, G. DE. Conservation des sols congolais et politique agricole. [**Soil conservation and agricultural policy in the Congo.**] *Bull. agric. Congo belge* 35, 1944 (118–36). [F.] [1070].

After a general review of the dangers of degradation and erosion of soil arising from disturbance of natural equilibrium in a country such as the Belgian Congo, which was largely covered with tropical rain forest before European occupation, the author combats the erroneous notion that soils in such forest are naturally rich. His accounts of the causes of and remedies for erosion are largely drawn from British publications. It should always be borne in mind that the planting of exotic species (e.g. *Eucalyptus*, *Cassia siamea*, *Casuarina*, *Tectona grandis*, etc.) chosen for their rapid growth, has the corresponding disadvantage that this rapid growth requires a large reserve of water and abundant, easily assimilable, nutrient elements in the soil. These species should only be planted in full knowledge of their requirements. It is emphasized that all measures for soil conservation can be adequately carried out only with the co-operation of the natives and that it is, therefore, of the first importance to make the need for soil conservation and the remedies for erosion comprehensible to the native mind.

11.62.11 (71.3) : 11.62.3 : 61.3 : 97.1 : 96 : 91.8. RICHARDSON, A. H. **A report on the Ganaraska Watershed: a study in land use for the rehabilitation of the area in the post-war period.** Dominion and Ontario Govts., Canada. 1944. pp. 248 + maps. [Department of Lands and Forests, Ont.] [1071].

It was estimated 20 years ago that 8,500 sq. miles of land in southern Ontario (in which the Ganaraska region lies) was marginal or submarginal for agriculture. In spite of the expanded conservation programmes of recent years, the submarginal areas are becoming larger, water in streams and wells is becoming less, and erosion of different types is increasing. The Ganaraska catchment, an area of about 103 sq. miles, was chosen from the older settlement areas of Eastern Canada to demonstrate the aim of intensive surveys and plans for future work. Its purpose is to give more exactness to (1) the specific procedures and techniques involved in the conservation and rehabilitation of a given area, (2) the cost of the necessary remedial projects, and (3) the amount and type of employment that will be provided. The techniques include the preliminary surveys, which are still necessary in other parts of southern Ontario as well as elsewhere in Canada.

Section 1 of the profusely illustrated report is a general account of the area, Section 2 consists of surveys of climate, soils (map), soil erosion and land use, economic aspects of agriculture, land use and resources, vegetation,

forest insects, diseases, and fish, together with recommendations for further surveys. Section 3 recommends conservation measures, of which the most important is the establishment of a 20,000-acre forest on marginal and submarginal land (map). Some system of controlled cutting of farm woodlots should be established and clear cutting stopped in some areas. Engineering works to control floods, the adoption of contour ploughing and strip cropping, and eradication of *Ribes* species to control blister rust are recommended. Woodlot improvement, reforestation and flood control would provide the bulk of the employment in the area. Other measures providing employment are the improving of streams for fish, forest-insect surveys, gathering maple syrup, planting permanent snow-fences on highways, roadside planting, and collection of tree seed.

Section 4 deals with administration and finance of the recommended projects; it is estimated that they would provide work for 600 men for 18 months excluding the winter months, at a total cost of $1,382,250.

11.62.11 (89) : 23.3 : 23.21. SAPRIZA VERA, C. La erosion y los medios de dominarla. [**Erosion and methods of control.**] *Suelo argentino* 4, 1945 (306–11, 324, 326, 374–81, 388). [Span.] [1072].

Although tree planting cannot in itself convert eroded land to a state of normality, it is, nevertheless, of great value in the reclamation of such land by improving soil conditions and reducing the amount of erosion which takes place, and by the economic, climatic and hygienic advantages which a forest affords. Forests are of particular importance economically in areas which are too poor to support agricultural crops except in return for a disproportionate amount of labour.

The main species employed in erosion control in Uruguay are *Acacia longifolia*, *A. cyanophylla*, *Populus nigra* and *P. alba*. These species have all given very encouraging results. Good results under special conditions have also been obtained with *Eucalyptus* spp., *Tamarix gallica* and *Salix* spp. *Salix alba* var. *caerulea*, *S. babylonica*, and *S. viminalis* have proved particularly valuable in the afforestation of badly drained land which is liable to flooding.

The following species are listed and discussed from the point of view of their suitability for erosion control: *Acacia longifolia*, *Populus nigra*, *P. alba*, *Salix viminalis*, *S. alba* var. *caerulea*, *Tamarix gallica*, *Bambusa arundinacea*, *Guadua angustifolia* and *Eucalyptus* spp. Practical information is given on propagation, methods of planting and transplanting and on the adaptability of the plants to the environmental conditions. No attempt is made to consider botanical characters, which do not come within the scope of the work.

The types of erosion which are discussed in the article are those caused (1) on roads by the transit of vehicles and animals; (2) in cultivated land by soil loosening and bad methods of cultivation; (3) by torrents and rivers; and (4) by wind erosion. Methods of control are suggested for each type, and species suitable for planting in eroded areas are discussed.

Erosion of cultivated land is the most serious type in Uruguay, and gully formation must be controlled not only in order to check the work of destruction but also to avoid loss of soil fertility. When gully formation has started, cultivation of the affected zone must be abandoned, and after the planting of woody species the area must be closed to animals for about 5 years. Spontaneous herbaceous vegetation also plays an important part in preventing the transport of soil by water. Areas seriously affected by erosion can be made suitable for intensive agriculture again only at great cost, whereas if they are put under forest, they may be made to yield comparatively high returns.

The species recommended for erosion control in areas which have been under cultivation are *Eucalyptus*, *Acacia nigra*, *A. melanoxylon*, *Cupressus lambertiana*, *C. glauca*, *C. horizontalis* and *Casuarina stricta*. Details are given of the arrangement and spacing of the plants. If the gullies are deep, the same procedure is followed as for erosion on roads, using chiefly *Acacia longifolia*, Poplars and Willows. At a later stage, when erosion has been checked, species intended for industrial exploitation, such as conifers, *Eucalyptus*, Elms, *Casuarina*, *Acacia nigra* and *Gleditsia*, may be introduced.

Damage caused at certain periods of the year by high water in streams and rivers can be substantially reduced if the margins are protected by either exotic or indigenous woody plants, such as Willows, Poplars and certain Eucalypts.

Wind erosion is not a serious problem in Uruguay, although it is responsible for much damage in some other parts of America. Tree growth on affected areas provides a physical

barrier to soil movements, and the constant production of organic material (which cements the soil particles together) and the binding of the soil by the root system of the tree tend to stabilize the soil.

The species of greatest value for windbreaks are the Eucalypts. Poplars, *Cupressus* and *Casuarina* are also suitable for this purpose. Plants suitable for low shelterbelts include *Acacia longifolia*, *A. cyanophylla*, *A. melanoxylon*, and Tamarisk (particularly the first-named). Practical details are again given for spacing and arrangement.

11.62.11 (97). TEMPANY, H. A., RODDAN, G. M., and LORD, L. **Soil erosion and soil conservation in the Colonial Empire.** *Repr.* from *Emp. J. exper. Agric.* 12, 47, 1944 (122–53). [1073].

The position of erosion control and soil conservation in the various dependencies is described, with some account of the methods employed. The various sections were revised by the agricultural authorities of the territories concerned, and the information presented summarizes the position at the time of publication. The following colonies and dependencies are included: Kenya, Tanganyika, Northern Rhodesia, Nyasaland, Somaliland, Zanzibar, Basutoland, Bechuanaland, Swaziland, Gambia, Gold Coast, Nigeria, Sierra Leone, St. Helena, Ceylon, Hong Kong, Malaya, Mauritius, Seychelles, Aden, Cyprus, Malta, Palestine, Trans-Jordan, British West Indies, British Guiana, British Honduras, Falkland Islands and Fiji.

11.62.31 : 91.3 : 11.6.2.2. SMARAGDOV, D. G. Vliyanie lesov na gruntovoe pitanie rek. [**The influence of forests on the feeding of rivers by ground water.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (259–67). [Russ.] [1074].

This paper summarizes the results of various investigations. The relation of forests to the water régime of rivers, either as large blocks of forest or as individual wooded areas within the large blocks, varies a great deal and may be classified into 3 broad categories:—(1) Forested areas that secure the intake of a considerable amount of the surface run-off and play an important part in regulating the supply of ground water to the rivers. (2) Forested areas which, despite their absorption of surface run-off, are capable of supplying only insignificant amounts of water to rivers. (3) Forests where the expenditure of moisture may be greater than the intake of run-off. In the last case the deficit of moisture is compensated by the inflow of ground water. This may occur where excessive amounts of moisture are lost by evaporation owing to a high water table combined with shallow soil.

The paper is concerned chiefly with forested areas belonging to the first category. Such areas act as reservoirs of ground water, and are found on territory either with a comparatively low water table, or with soil types of varying permeability to water, but without excessive moisture. Other important factors that influence surface and subsoil flow are: geology of the area under forest; its distribution in relation to the 'hydrographic network'; relief; and types and conditions of surrounding land.

Stand composition, age, structure, and density (from 0·5–0·6 and higher) are of comparatively small practical significance compared with the above-mentioned factors.

Forested areas acting as reservoirs of ground water perform their rôle in full only if: (i) occupied by a well developed stand; (ii) every part of such forest grows on a suitable site and utilizes it in full in the process of development; (iii) the structure of the forest soil and litter is not subjected to artificial disturbances. This especially applies to areas of sandy soil, as in some situations such soil may be subject to choking by fine sediments.

All wooded areas of possible value as ground-water reservoirs in the water-conservation zone should be classified according to these principles.

When planting trees on various sites in the vicinity of the forest reservoir, care should be taken to select the species suited to the site and of known value in water regulation and erosion control.

Regeneration and control measures, ordinary and special tending operations, should be carried out with care on each area of the forest reservoir. Clear felling of large areas, grazing, construction of roads and other intrusions adversely affect the development of forest litter, the moss layer and the structure of the soil, and destroy the water-regulating influence of the forest.

Forested areas apart from those under (1) do not demand any special measures to increase and preserve their water-regulating function.

Improved organization and forest management technique, by increasing the productivity of these forests, would indirectly guarantee the fulfilment of their hydrological rôle so far as the locality conditions allow.

11.62.31 (54.1 : 54.2) : 23.3. **The Damodar floods and afforestation.** *Sci. and Cult.* 9, 1944 (506–7). [Central Board of Irrigation.] L.S. [1075].

The Central Board of Irrigation, India, presents further evidence on the value of afforestation in reducing floods in order to refute an adverse commentary on the discussion of the Damodar floods and general flood control in *Sci. and Cult.* 9 (232).

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Nutrients*

12.11.1 : 21.3 : 07.7. ANDERSON, A. J. **Double-compartment pot cultures for studies in plant nutrition.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 17, 1944 (144–50 + plates). [Waite Agricultural Research Institute, Univ. of Adelaide.] [1076].

Previous uses of double-compartment pot cultures for the investigation of certain problems in plant nutrition are described and discussed. A detailed description is given of a new method which enables plants to be grown in a soil and at the same time obtain some of their nutrients from a water culture. One compartment, with a floor through which plant roots could penetrate, was situated directly above a second compartment. Soil equipped with an automatic irrigator was placed in the top compartment; the lower compartment contained a water-culture solution. Roots developed in the soil and also normally in the humid air between the two compartments. By this method, direct contact between the soil and an added nutrient can be avoided, and the effect of nutrients provided in a culture solution can be compared with the effect of the same nutrients added to the soil. The method is particularly suitable for studies with legumes.

The method was employed (*a*) in preliminary tests to investigate the effect of the nutrient solution on root growth, and (*b*) in an experiment to compare the effects of phosphate added to the soil and to the solution. Within the range of treatments employed, roots developed only in solution containing calcium sulphate. The concentrations employed were 1·376 and 0·344 grams of $CaSO_4.2H_2O$ per litre. Plants did not respond to phosphate in solutions from which calcium sulphate was omitted.

12.11.14 : 12.25 : 12.26–8. KRASULIN, N. P. Opȳt opredeleniya transpiratsii sosnȳ i berezȳ v usloviyakh nasazhdeniya. (Predvaritel'noe soobshchenie.) **[Experiment on the determination of transpiration by Pine and Birch in the stand. (Preliminary report.)]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 8, 1939 (253–8). [Russ.] [1077].

Experiments were carried out in the Oka basin on three sample plots:—(*a*) 15-year-old Pine of density 0·9 on a dune ridge with a low ground-water level; (*b*) 9-year-old Pine of density 1·0 on a pronounced slope with a ground-water level only 1–2 m. below soil surface; and (*c*) 8-year-old Birch of density 1·0 with a low ground-water level. Transpiration was measured by the rapid weighing method and was calculated as the weight loss of branchlets during 3 minutes in percentage of the air-dry weight of the foliage.

The results were:—(1) The mean transpiration rate of both species fell as the season (June–August) progressed. (2) Transpiration was greater in June, and at this period Birch foliage transpired twice as much as Pine. (3) The absence of rain during July and the resulting drop in the soil moisture were accompanied by a sharp decrease of transpiration to a value near 1 per cent. for the three stands concerned. (4) With continued drought and high air temperatures in August, the transpiration rate of Pine decreased further in both Pine stands to 0·5 per cent., whereas that of Birch remained at the July level, which seems to represent the minimum for this species and was maintained by partial shedding of the leaves. (5) On the basis of total foliage per sample plot the relation of the above figures is greatly altered in that, on the soils with a deep ground-water level, there was no appreciable difference between the Pine and Birch stands in the amount of water consumed during July and August, though in both of these months the corresponding figure for Pine on the site with a high ground-water level was three times as high. It is therefore concluded that external factors, particularly available soil moisture, must be considered as much as the species concerned

when studying transpiration as an element in the water balance of forests.

12.11.2. *Propagation. Growth. Development*

12.11.21 : 12.25. NEWCOMER, E. H. **Induced parthenocarpy in *Ginkgo*.** *Amer. Nat.* 79, 1945 (186–7). [Department of Botany, Univ. of North Carolina.] L.S. [1078].

Although the induction of parthenogenesis, especially by the use of foreign pollen, appears more likely of success with the gymnosperms than with the angiosperms where extensive stylar tissue acts as a barrier, a case is recorded of a female *Ginkgo* pollinated on April 7th, 1943 with pollen from *Cedrus deodara*, in which many ovules did not abort, but persisted and slowly increased in size for several weeks before dropping. Of the four seeds recovered, two were markedly reduced in size, but, to all appearances, normal in every other respect. After winter layering in sand, the two larger seeds and the remaining small seed were planted in the greenhouse in early March. The small seed promptly died but the two larger seeds cracked their coats and appeared to be growing. After three months one seed died without having put forth either radicle or shoot, while the other seed, while remaining alive, appeared not to be developing further. It is impossible to say what apomictic mechanism was responsible for their development, but pseudogamy is certainly indicated.

12.11.21 : 12.25 : 23.23.11. ROE, E. I. **Viable seed produced by 12-year-old Red Pine.** *J. For.* 43, 1945 (678–9). [Lake States Forest Exp. Sta.] [1079].

Although Red Pine (*Pinus resinosa*) trees have been found to produce flowers at an early age, there is apparently no record of their early seed production. The writer reports finding cones in 1944 on a 12-year-old Red Pine. Of 16 seeds taken from 4 cones, all germinated within 6 to 10 days in sphagnum moss.

12.11.22. KNIGHT, F. P. **The vegetative propagation of flowering trees and shrubs.** *J. R. hort Soc.* 70, 1945 (319–24 + plates). O.B.D. [1080].

General information on the propagation of woody species by simple division, layering, cuttings, budding and grafting. The section on cuttings includes notes on internodal cuttings, leaf-bud cuttings, root cuttings, and chemical treatment.

12.11.22 : 12.11.15 : 12.26–8 : 01.7. HITCHCOCK, A. E., and ZIMMERMAN, P. W. **Methods of rating the root-inducing activity of phenoxy acids and other growth substances.** *Contr. Boyce Thompson Inst.* 14, 1945 (21–38). [1081].

A complete list of 63 phenoxy compounds tested in 1943 is given, together with the average number of roots induced on cuttings of Privet (*Ligustrum ovalifolium*). The results of these tests were described only briefly in a previous report. Eighteen of the phenoxy acids used in 1943 were tested again in 1944 using a greater number of replicated tests. The relative order of activity was approximately the same in both years' tests ($r_s = \cdot 696 > P \cdot 01$). The relation between structure of acid and root-inducing activity was also essentially the same for both years' tests.

The group ranking of 12 of the active acids was essentially the same by Friedman's method of ranks and the analysis of variance. Only two of the acids [2, 4, 5-trichlorophenoxyacetic and α-(2, 4, 5-trichlorophenoxy)-propionic acids] were of equivalent activity to *NA*. The dichlorophenoxy and most of the monochlorophenoxy acids were of intermediate activity. α-(2, 5-dimethylphenoxy)-propionic and α-(2-chlorophenoxy)-propionic acids were of lowest activity.

The loss of information attending the use of the method of ranks appears not to be a serious one in this type of test and is compensated for, to a considerable extent, by the simplicity and time-saving element of the method. *Authors' summary.*

12.11.22 : 12.26–8 : 12.11.3 : 34.26 (68.9). NYASALAND. **Report of the Department of Agriculture for the year 1944. Part I. Agriculture in Nyasaland. Part II. Experimental work.** Govt. Printer, Zomba. [1945?] pp. 8 + 12. [1082].

The main aim of work at the Tung Experimental Station has continued to be the production of improved planting material of *Aleurites montana*. This is being attempted by the selection of promising mother trees, their propagation as buddings on seedling rootstocks, the production of legitimate seedling families by selfing or crossing between high-yielding trees, and the use of certain other types of selected seed. An experimental planting made in December, 1940, compares unselected seedlings, open-pollinated seedlings from 4

selected trees, and buddings of the same 4 selections on rootstocks of *A. montana* and *A. fordii*. Measurements of girth show that both types of seedling have made more growth than buddings and that buddings on *A. montana* stocks are more vigorous than those on *A. fordii*. The dwarfing effect of the *A. fordii* stock is especially noticeable. Buddings gave significantly greater yields than seedlings. There was no significant difference in the effect of the two rootstocks on yield.

Although all budding has been done on seedling stocks, which must necessarily introduce some degree of variation in the resulting composite plants, certain characteristics of the mother tree are reproduced with remarkable uniformity in all buddings derived from them. The majority of clones belong to one or other of two distinct types. Type A grows vigorously, tends to make its first branches relatively high, and thereafter produces whorl after whorl of primary branches at fairly long intervals on the main trunk, resulting in a strong-growing, erect and open type of tree. Type B is less vigorous, branches low and at very short intervals, and makes low, dense bushy trees. Type B produces far more potential fruiting points in the early years and is usually more precocious in bearing than type A. It cannot yet be said which of these types is likely to prove the more profitable.

The top working of established male trees by budding on the branches with scions from high-yielding mother trees was shown to be a successful means of converting them to good bearers in 1941–2, and has since been extensively practised on estates. Budding on the secondary branches appears preferable to budding on primaries, as it results in less wind damage and die-back. The first yields from top-worked trees on one planting were obtained this year, and it was found that the trees budded on their secondary branches outyielded the others in all cases except where one particular clone was used as scion. This interaction between clone and method of top working was unexpected and cannot at present be explained. (II, pp. 7–8.)

12.11.22 : 12.26–8. MIROV, N. T., and CUMMING, W. C. **Propagation of Cork Oak by grafting.** *J. For.* 43, 1945 (589–91). [California Forest and Range Exp. Sta., Berkeley, Calif.] [1083].

This article reviews existing European literature on the propagation by grafting of Cork Oak (*Quercus suber*) and gives an account of greenhouse and field experiments carried out during 1943 and 1944 in California. The purpose of the greenhouse experiments was to discover what compatability might exist between *Q. suber* and various native Oaks; good results were obtained in grafting *Q. suber* on to *Q. chrysolepis*, *Q. kelloggii*, *Q. douglasii*, and *Q. engelmanni*, but attempts to use *Q. agrifolia* and *Lithocarpus densiflora* as stocks were unsuccessful. The preliminary field tests, made to determine what conditions are necessary for survival and development of the grafted material, indicate that (1) grafting Cork Oak under field conditions is possible; (2) shading during the first season is necessary; (3) removal of sprouts originating from dormant buds of the stock below the graft is imperative for survival and vigorous development of the scion.

12.11.22 : 12.26–8 : 12.11.15. LEDEBOER, M. S. J. **Vegetative propagation of tan Wattles.** *J. S. Afr. For. Ass.* No. 12, 1944 (29–32 + plate). [Division of Botany and Plant Pathology, Pretoria.] [1084].

In experiments to determine the best method of vegetative propagation of *Acacia mollissima* it was found that cuttings taken and planted in a variety of treatments did not produce callus or roots. A method of layering by ring-barking branches or stems, or by making an upward cut into the bark and wood, and keeping the wounds covered with moist soil before severance from the tree, induces root formation.

12.11.3. *Heredity. Breeding. Races and questions of provenance. Cytology*

12.11.3 (71). CANADA. **Report of the Lands, Parks and Forests Branch for the fiscal year ended March 31, 1944.** *Repr.* from Annual Report of the Department of Mines and Resources, Canada. 1945 (61–107). [1085].

Work of the Sub-committee on Tree Breeding of the Associate Committee on Forestry, National Research Council, is progressing favourably. Strains of White Pine that give promise of resistance to blister rust and weevil, Poplar suitable for pulpwood and match stock, and for prairie shelterbelt planting, and Spruce of rapid growth are receiving particular attention (p. 98).

12.11.3 (485) : 06.1. SYLVÉN, N. Föreningen för växtförädling av skogsträd. Styrelseberättelse för år 1944. **[The Association for Forest Tree Breeding. Report of the Board, 1944.]** *Svensk PappTidn.* 48, 1945 (113–6). [Sw.] C.G.B. [1086].

Particulars are given of the establishment of the Sundmo branch station, which, when completed, should be of special importance for Norrland, and to the developments and extension of the Brunsberg and Ekebo stations.

Funds and grants received by the Association and the organization of the sale of improved types of trees are also discussed.

12.11.3 (485) : 23.23.1. Plan utarbetad för frö- och plantförsörjning. **[Plan worked out for supplying seed and plants.]** *Svensk Papp-Tidn.* 48, 1945 (149–50). [Sw.] C.G.B. [1087].

A committee has been appointed in Sweden to examine the question of the provision of seed and plants by the forestry boards. The country will be divided into supply areas, each with a joint organization committee.

The forests are to be surveyed and mapped from the point of view of their suitability for seed collection. A uniform classification scheme for seed will be drawn up and a forest cultivation programme formulated in collaboration with the forestry board and the forestry research institutes.

12.11.3 : 23.23.11 (485). JENSEN, H. Inavelsrisken vid skogsfröplantager. **[The risk of inbreeding in forest seed plantations.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (178–80). [Sw.] [1088].

In voicing fears that Jensen's proposals for establishing model seed plantations [cf. *For. Abstr.* 5 (252); 7 (No. 79)] would introduce the risk of deterioration through inbreeding, Sylvén appears to have misconceived Jensen's programme, which involves the formation of mixed plantings of grafts from 6 superior genotypes, thus giving an initial possibility of 15 different combinations by crossing. If further superior strains were discovered, they were also to be incorporated in the mixed plantings, the seed from which would be sown in nurseries and subjected to selective thinning so as to leave only the 5 per cent. of the most vigorous plants, which would be used to establish the final seed plantations.

12.11.3 : 12.25 : 21.1 (485). LANGLET, O. Om möjligheterna att skogsodla med gran- och tallfrö av ortsfrämmande proveniens. **[On the possibilities of raising forest with Pine and Spruce seed of non-local provenance.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (68–78). [Sw.] [1089].

Since it is at present impossible in Sweden to obtain sufficient seed of purely local provenance to meet the demand, particularly in Norrland, an attempt is made to define provisionally the limits within which other seed may be used without undue risk. Major northern and southern zones are delimited by a line running from the Norwegian boundary of Värmland at about 60° N. to the northern boundaries of Örebrö, Västmanland, and Uppsala.

Spruce seed from the southern zone can be used over the whole of this zone provided that the restrictions imposed by altitude and displacement southwards are observed. In the northern zone it should never be used more than 250 km. north of its origin. Over the whole country it should not be used at altitudes greater than 200 m. above the mean altitude of origin, and for every 50 km. northwards the allowance for altitude must be reduced by 50 m. For movement southwards the limit appears to be 200 km. and with simultaneous altitudinal displacement an extra 50 m. may be allowed for every 50 km. southwards. Similar recommendations are made for displacement to a lower altitude. Seed from Finland, East and North Norway and the Baltic provinces may be used as if it were collected at identical latitudes and altitudes in Sweden. Use of Central European seed ought to be restricted to the southern zone, and preference should be given to seed from Swedish stands of Central European provenance rather than to imported seed.

There is greater risk in using Pine seed at any distance from its place of origin. In the southern zone it should be used not more than 250 km., and in the northern zone not more than 150 km. north of its origin. Displacement to higher altitudes should not exceed 200 m. in the former and 100 m. in the latter zone, and for every 50 km. northwards the permissible shift in altitude should be reduced by 50 m. For displacement southwards the recommended limit is 200 km., with similar allowances for altitude. It appears that Pine seed should not be used more than 300 m. in the southern, or 200 m. in the northern zone, above its origin. Displacement to lower

altitudes should be governed by similar rules. Pine seed from Finland, northern Norway and the Baltic countries may be used as if it were from identical latitudes and altitudes in Sweden. In tracts with a special climate, e.g. the maritime tracts of Halland and Bohuslän, seed should be from regions as similar as possible.

If seed collected according to these recommendations cannot be obtained in sufficient quantity to meet the whole demand, it would seem better to allow certain areas to wait, rather than to risk using seed that might prove unsuitable.

12.11.3 : 12.25 (489) : 23.23.12. THAARUP, P. Bastarden Sitkagran × Hvidgran. [**The hybrid Sitka Spruce × White Spruce.**] *Dansk Skovforen. Tidsskr.* No. 9, 1945 (381–4). [Dan.] [1090].

Where Sitka Spruce (*Picea sitchensis*) and White Spruce (*P. glauca*) are grown in proximity under Danish conditions, crossing occurs to such an extent that it is impossible to harvest pure Sitka seed. Brief descriptions and sample-plot data are given for hybrid stands in Husby Plantation and Tornby Plantation. The Husby stand had reached a mean height of 9·0 m. and a volume of 83 cu.m. at 27 years from seed, but was abnormal in that every second row had consisted of *Pinus montana*, which had been overtopped and was cut out when the plot was established. In spite of the very poor soil in this locality, the height growth of the hybrids corresponded to that of Norway Spruce on site quality II. At 25 years of age the Tornby stand had a mean height of 9·9 m. and a volume of 200 cu. m. immediately before thinning, which brought the mean height to 10·0 m. and volume to 157 cu.m. Before a second thinning carried out 3 years later, the mean height was 11·5 m. and the volume 219 cu.m.; the mean annual increment for the intervening period was therefore 0·5 m. in height and 20·7 cu.m. in volume. These growth figures also correspond approximately to those for Norway Spruce on site quality II. Unfortunately in both of the stands examined all the stems were of bad form. Neither of the parents normally has good stem form, but the hybrids were worse, all the stems being crooked or slanting though with no apparent sign that this was due to damaged leaders or other external factors. It was hoped that the hybrids might prove more frost-hardy than Sitka Spruce, but in the heavy frost of 1938, which killed or damaged Sitka and White Spruce, Douglas Fir, and other species, they were no less susceptible. The hybrids appear to have no advantage over Sitka Spruce, and in view of the poor stem form a warning is issued against their use and against the collection of Sitka Spruce seed from localities where there is any danger of crossing with White Spruce.

12.11.3 : 12.25. FASSETT, N. C. ***Juniperus virginiana*, *J. horizontalis* and *J. scopulorum*—IV. Hybrid swarms of *J. virginiana* and *J. horizontalis*. V. Taxonomic treatment.** *Bull. Torrey bot. Cl.* 72, 1945 (379–84, 480–2). [Univ. of Wisconsin, Madison, Wis.] O.B.D. [1091].

Except in the regions where *Juniperus virginiana* and *J. horizontalis* overlap, the two species are quite distinct in several characters, including the following: (1) The epidermal cells of the leaves of *J. virginiana* average 9–12μ in width, those of *J. horizontalis* 13–19μ. (2) The leaf tips of *J. virginiana* are rarely apiculate, those of *J. horizontalis* always apiculate. (3) *J. virginiana* is an erect tree, *J. horizontalis* a creeping shrub. (4) In *J. virginiana* not more than a third of the peduncles of the female cones are curved, and in *J. horizontalis* half or more are curved.

In the Driftless Area of Wisconsin where the two species grow together in the same colony, various intermediates occur, the commonest being that described as *J. virginiana* var. *ambigens* which combines the creeping habit of *J. horizontalis* with the fruit of *J. virginiana*.

Part V includes two maps showing the approximate range of the three main species (*J. virginiana*, *J. scopulorum* and *J. horizontalis*) and their varieties. A key is given for the identification of *J. virginiana*, *J. virginiana* var. *crebra*, *J. virginiana* var. *ambigens*, *J. scopulorum*, *J. scopulorum* var. *columnaris* var. nov., *J. scopulorum* var. *patens*, and *J. horizontalis*. [See also *For. Abstr.* 7 (No. 82).]

12.11.3 : 12.26–8 : 44.1 : 23.22. SCHREINER, E. J. **Variation between two hybrid Poplars in susceptibility to the inhibiting effect of grass and weeds.** *J. For.* 43, 1945 (669–72). [1092].

Hybrid Poplars are particularly susceptible to grass effect and cannot be successfully established on old fields without elimination of the sod and weeding for at least one year. Experimental results (to be presented in a later paper)

indicate that the inhibiting effect of grass on Poplars involves more than mere competition for moisture and nutrients. An experiment designed to determine the degree of site preparation and after-care necessary for successful establishment of hybrid Poplars [cf. *For. Abstr.* 7 (No. 730)] has also provided evidence on inherent variation in susceptibility to the grass effect. Hybrid Poplars (with the possible exception of the White Poplar and Aspen groups) are too susceptible to the inhibiting effect of grass and weeds to offer the probability that types may be found which can be planted directly in sod. It is possible, however, that clones with sufficient resistance to make weeding after planting unnecessary, may be discovered or developed by breeding. Hardwood species such as Maple, Birch and Ash, which gradually take possession of abandoned fields, appear to offer good possibilities for the selection (or creation by breeding) of hardwood types that may be successfully established in sod without site preparation.

12.11.3 : 12.26–8. HÅKANSSON, A. Die Chromosomenpaarung von zwei *Salix*-Bastarden. [**Pairing of chromosomes in two *Salix* hybrids.**] *Hereditas, Lund* 30, 1944 (639–41). [G.] [Botanisches Institut, Lund.] L.S. [1093].

The genus *Salix* has the chromosome count $n = 19$, with tetraploid, hexaploid and octoploid species. Where hybrid plants possess an even number of genomes complete pairing is normal, but an uneven number leads to a more or less pronounced univalent formation and consequent disturbances in division. In this paper the author discusses chromosome pairing in two artificially produced hybrids: *Salix lapponum* × *hastata*, a markedly sterile plant, and *S. viminalis* × *triandra*, a hybrid which sometimes occurs in nature. The results of the investigations indicate that the genomes present in the various species are cytologically very similar. In the case of *Salix lapponum* × *hastata*, meiosis was completely normal. The divisions were regular and led to the formation of four macrospores. It appears therefore that the marked sterility of the hybrid is not due to chromosome disturbances. In *S. viminalis* × *triandra* pairing was always incomplete, and there was invariably a number of univalents. The incomplete pairing probably arises from the fact that *Salix triandra* belongs to the section *Amerina*, whereas the other *Salix* species investigated belong to the section *Caprisalix*. Not only morphological differences but also significant differences between the genomes exist between the two sections.

12.11.3 : 23.23.1 : 12.26–8 (54.8). KADAMBI, K. **Teak-seed origin experiments in Mysore.** *Indian For.* 71, 1945 (265–9 + plate). [1094].

It has long been observed by forest officers in Mysore that Teak seed from the Kahankote (moist) district of Mysore, when used in plantations, produces stunted, relatively low, branchy trees with a relatively large number of insect galls. Trees of this origin are also more susceptible to defoliator attack, shed their leaves earlier, and sprout later than do those of Shimoga (Mysore dry) origin. Experimental plots were established in 1932 in several parts of Mysore to study the influence of Teak seed provenance. The experiment is described and the results analysed. Present indications are that under Mysore conditions and for the Mysore Teak zones, both moist and dry, Nilambur (Madras) origin is the most suitable and Shimoga (Mysore dry) origin next best.

12.12. Teratology

12.12 : 12.25 (75.9). RHOADS, A. S. **Witches'-brooms of Pine trees in Florida.** *Plant Dis. Reptr.* 29, 1945 (26–8). I.M.I. [1095].

Observations were made during the first half of 1944 on the occasional occurrence of a striking type of witches' broom of undetermined origin on three species of Florida Pines: Pond Pine (*Pinus rigida* var. *serotina*), Sand Pine (*P. clausa*) and Slash Pine (*P. caribaea*). In *Pinus rigida* var. *serotina* the brooms are usually found at the lower or median portion of the crown, while in *P. clausa* only a single branch (usually high up in the crown, but occasionally on the lower limbs) appears to become involved in the broom formation in any one tree. One case is reported of a particularly large witches'-broom formation on Slash Pine, originating on a large limb in the lower portion of the crown, about halfway up the bole, and having a spread of about 20 ft. Gigantic witches' brooms of this type develop at the expense of the balance of the tree.

12.13. Embryology

12.13 : 12.26–8. PANTULU, J. V. **Studies in the Caesalpiniaceae. I. A contribution**

to the embryology of the genus *Cassia*. *J. Indian bot. Soc.* 24, 1945 (10–24). [Maharaja's College, Vizianagram.] O.B.D. [1096].

A paper dealing with the structure and development of the ovule and embryo sac of *Cassia* spp. based on examination of material representing *C. occidentalis*, *C. obtusifolia*, *C. glauca*, *C. glauca* var. *suffruticosa*, *C. marginata*, and *C. siamea*.

12.14. Organography. Morphology. Anatomy. Histology

12.14 : 12.26–8. GAZET DU CHATELIER, M. G. Recherches sur les Sterculiacées. [**Research on the Sterculiaceae.**] *Rev. gen. Bot.* 1940 (174–91, 211–33, 257–84, 305–32). [F.] O.B.D. [1097].

A comprehensive account of the morphology of the Sterculiaceae based on the examination of 170 species of 35 genera. The species *Sterculia platanifolia* was chosen as the starting point on which to base the work of research. The anatomical structure of the stem, root and flower of this species is studied in detail, and a critical comparative account is given of the floral and leaf characters of the family as a whole, particular reference being made to the occurrence of pseudo-obdiplostemony.

The genus whose floral structure most nearly approaches the stock characters of the family is *Eriolaena*, which is regarded as being most closely related to the original type.

12.14.3 : 12.25 : 12.11.23 : 23 : 21. ANDERSSON, E. Om barrträdens rotverksamhet. [**On the root activity of conifers.**] *Svenska Skogsv-Fören. Tidskr.* 43, 1945 (291–315). [Sw.] [1098].

From observations in various localities over a period of 40 years it is concluded that root invasion is not normally aggressive in character. By the drain on their own root zone, plants and trees render this zone unattractive to other roots. This applies to regeneration as well as to grown trees, and young plants are likely to make headway so long as their root systems are not completely encircled by others. When invading fresh sources of moisture and nutrients, the first comer may render them unavailable to other root systems; hence competition in this sense is a race, and specific or individual differences in rate of root growth become important. Spruce roots appear to grow about twice as fast as those of Pine, and are thus able quickly to exploit gaps, thinned areas and margins of felling sites. Root invasion is especially active from dense stands where competition is strong, whereas thinned stands show much less invasion of adjacent open areas. When seedbearers are left on a felling site, there is a delay before crown development and root growth combine to exploit the new opportunities. If, therefore, regeneration is established during this delay, extension of the root system of seedbearers will be inhibited and there will be only small blanks immediately over the original root area of the parents. On poor sites with slow regeneration root systems of the parents are able to invade to a radius of 2·5–3 m. before being checked by the development of regeneration. Root competition is less intense on the higher site qualities and for this reason shelterwood or selection methods are more successful there than on poor sites. Improved illumination does not lead to light increment if there are inadequate opportunities for root growth.

The chief signs that active root invasion is occurring are blanks in regeneration and tree growth disproportionately large for the site quality. Where invasion has already caused blanks, root pruning will be effective; where invasion is feared, the old stand should be thinned in a strip 15–20 m. wide along the margin, taking out Spruce in preference to Pine. Soil cultivation and clearing of bushes are an aid to the establishment of regeneration before root invasion occurs. The difficulties met with in filling blanks are held to be due to root invasion and should be remediable by root pruning with a sharp spade round the edges of the blank. Sample plots are likely to give misleading results if laid out near open land or gaps.

12.14.3 : 12.25 : 11.49.5. LEBARRON R. K. **Adjustment of Black Spruce root systems to increasing depth of peat.** *Ecology* 26, 1945 (309–11). [Lake States Forest Exp. Sta., St. Paul, Minn.] [1099].

Black Spruce (*Picea mariana*) has generally a shallow, spreading root system with no definite tap roots, and this habit is not modified by drier or better aerated soils. The root system is, however, profoundly changed when the surface of a swamp is raised by the accumulation of organic litter and the growth of sphagnum moss. The root system is kept near the rising soil surface by means of adventitious

roots which develop on the stem of the tree above the original root collar. An illustration is given of a tree from a Minnesota swamp about 140 years old and 5 in. d.b.h. with at least 5 successive strata of roots. The same process has been observed on Black Spruce in Ontario and on an unidentified species of Spruce in Alaska. The adventitious roots dominate and finally suppress the old system. The process is believed to be due to the better aeration near the surface of the soil.

12.14.4 : 12.25 : 12.11.23. STERLING, C. **Growth and vascular development in the shoot apex of *Sequoia sempervirens* (Lamb.) Endl. II. Vascular development in relation to phyllotaxis.** *Amer. J. Bot.* 32, 1945 (380–6). [Univ. of California, Berkeley, Calif.] O.B.D. [1100].

The procambial strands in *Sequoia sempervirens* differentiate acropetally in the shoot apex from older strands below. The strands are always continuous, and they are present in the apex previous to the emergence of their respective leaf primordia. There are no cauline bundles in the Redwood shoot. The bundles are common to both stem and leaf. The type of bundle linkage, and the corresponding leaf arrangement, vary in different shoots. In the same shoot, however, the manner of trace branching remains quite regular. Various types of leaf and leaf-trace arrangements have been noted. Complementary (i.e. anodal and cathodal) spirals are common. Two procambial strands branching from leaf traces below are present at the emergence of the bud primordium. These two strands are the vascular bundles of the future opposite prophylls of the bud. The traces to the other leaves of the bud develop from the above-mentioned primary bundles.

Various theories of phyllotaxy are discussed in relation to the results of the investigation. An attempt is made to relate leaf arrangement to vascular development in the shoot. *From author's summary.* [See also *For. Abstr.* 7 (No. 613).]

12.14.7 : 12.26–8. ERDTMAN, G. **Pollen morphology and plant taxonomy. IV. Labiatae, Verbenaceae, and Avicenniaceae.** *Svensk bot. Tidskr.* 39, 1945 (279–85). [E.] O.B.D. [1101].

A discussion on the taxonomy of the Labiatae, Verbenaceae and Avicenniaceae in relation to their pollen morphology. A regrouping of the Labiatae is suggested according to whether the plant in question has tricolpate (or, exceptionally tetracolpate), binucleate pollen grains or hexacolpate, trinucleate pollen grains. Pollen morphology should also be of value in assisting taxonomists to classify the genera and sections of the Verbenaceae (particularly the pollen-morphologically diverse group, Verbenaceae-Verbenoideae), and in assigning doubtful genera to the proper family, whether Labiatae or Verbenaceae.

Since the genus *Avicennia* deviates so much (pollen-morphologically as well as in other respects) from the true Labiatae stock, it should probably be regarded as forming a family of its own.

12.14.7. ERDTMAN, G. **Pollen morphology and plant taxonomy. V. On the occurrence of tetrads and dyads.** *Svensk bot. Tidskr.* 39, 1945 (286–97). [E.] O.B.D. [1102].

An attempt is made in this paper to revive some of the terminology used by H. G. Reichenbach (1852) in his thesis on the pollen grains in the Orchidaceae (particularly the use of the terms dyads, triads, tetrads, hexads, octads, etc., to represent composite grains made up of two, three, four, six, eight, etc., grains) and to provide a preliminary, alphabetical list of families in which the pollen grains are united into dyads or tetrads. Annonaceae, Leguminosae, Magnoliaceae, Rubiaceae and Sapindaceae are among the families listed.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 (55). PETROV, M. P. Ocherk rastitel'nosti severnogo Irana. **[Short description of the vegetation of northern Iran.]** *Sovetsk. Bot.* No. 4/5, 1944 (46–59). [Russ.] O.B.D. [1103].

The regions distinguished are:—(1) Broadleaved moist forests of the Southern Caspian area; (ii) Steppes of the Turkoman-Khorassan hills; (iii) mountain semi-desert of the Turkoman-Khorassan and southern Khorassan hills; (iv) deserts of the central Iran hills; (v) meadow solonchaks of the Gorgano-Atrek depression.

The broadleaved forests of the Elbruz and Caspian coast are divided into (*a*) an upper zone of Hornbeam without underwood on northern slopes, and Oak/Hornbeam with underwood on

southern slopes; (*b*) a middle zone of Oak/*Parrotia persica* with or without underwood, also mixed mountain-gorge forests; (*c*) a lower zone of Oak/*Parrotia persica* or mixed forest with an underwood of Box; (*d*) maritime plain with mixed forest of Oak and mixed underwood, Alder/Oak forest with underwood, and Alder/*Pterocarya fraxinifolia* forests.

The forests are rich in species, the chief being *Quercus castaneifolia*, *Parrotia persica*, *Carpinus betulus*, *Ulmus scabra*, *Zelkova carpinifolia*. In swampy places *Alnus barbata*, *A. subcordata*, and *Pterocarya fraxinifolia* predominate. In the mountain-valley forests are found giant specimens of *Acer insigne*, *A. laetum*, *Fraxinus* spp., and *Tilia rubra*. *Viscum album* is a common parasite and is widely used in winter as fodder for milch cattle.

Notes are included on species of the underwood and field layers and on transitions to the other vegetation types, which are described in similar detail. Physical features and climate are also briefly discussed under each major type.

12.19 (729.7 : 729.9). BEARD, J. S. **Some ecological work in the Caribbean.** *Emp. For. J.* 24, 1945 (40–6 + plates). [1104].

This is an account of ecological work carried out in the eastern Caribbean colonies during the past five years, some of it pure research, some of it practical. The bulk of the information has already been published in scattered papers [cf. *For. Abstr.* 3 (266), 6 (79, 149)], and the present account is, therefore, more a review of literature than an original contribution. Eight profile diagrams of different types of forest are reproduced. *From author's summary.*

12.19 (79.4) : 11.45.4 : 43.3. BOWERMAN, M. L. **The flowering plants and ferns of Mount Diablo, California. Their distribution and association into plant communities.** J. J. Gillock and Co., Berkeley, Calif. 1944. pp. xi + 290. Price $3.75. Biol. Abstr. 18 (22481). [1105].

Mt. Diablo (3,849 ft.), situated 30 miles east-north-east of San Francisco, has a Mediterranean climate. The soils are almost entirely primary, and geological formations of every period from Jurassic to Recent are present. Fossil floras of Eocene to Middle Pliocene age show the transition from a subtropical to a more arid flora which includes some of the present-day species.

The following plant communities are described and illustrated: the broadleaved sclerophyll formation (*Quercus chrysolepis* and *Q. agrifolia*/*Aesculus* associations); the deciduous Oak/conifer formation (*Quercus douglasii*/*Pinus sabiniana* association, which includes the *Quercus wislizenii* consociation and the *Pinus coulteri* association); the riparian formation (*Alnus*/*Platanus* association); the grassland formation (*Stipa*/*Sitanion* association), the chaparral formation (*Adenostoma*/*Arctostaphylos*, *Quercus durata*/*Arctostaphylos glauca*, and *Quercus*/*Cercocarpus* associations), the rock societies, the springs, and the ponds.

The effect of fire upon the vegetation is discussed. Some correlation appears to exist between vegetation and type of rock.

The habitat, altitudinal range, abundance, period of blooming, associated species, and distribution upon the mountain have been independently determined for each of the 630 species of vascular plants (83 families) reported from the area.

12.19 (79.6). MYERS, R. M. **The vegetation of Idaho.** *J. sci. Labs. Denison Univ.* 38, 1943 (32–9). L.S. [1106].

Data are given on the distribution, climate, elevation and principal plant species of the following plant associations of Idaho: (1) Alpine tundra (*Carex*/*Poa* association); (2) Subalpine Spruce/Fir forest (*Picea*/*Abies* association); (2a) Lodgepole Pine subclimax (*Pinus* consocies); (3) Larch/Pine coast forest (*Larix*/*Pinus* association); (4) Petran montane forest (*Pinus*/*Pseudotsuga* association); (5) Palouse prairie (*Agropyron*/*Festuca* association); (6) Piñon/Juniper woodland (*Pinus*/*Juniperus* association; and (7) Great Basin sagebrush (*Artemisia* association).

The distribution of each vegetational type is indicated in an accompanying map.

12.19 (79.8 : 71.2). RAUP, H. M. **Vegetation along the Alaska Highway and the north Pacific Coast.** *J. N.Y. bot. Gdn.* 46, 1945 (177–91). [Arnold Arboretum.] [1107].

The Aleutian Islands are treeless except for some plantations of Spruce on Unalaska. Their principal vegetation types are meadow and heath-shrub communities. In some places thickets of Willow (*Salix barclayi*) are interspersed with the subalpine meadows. The southern and south-eastern coasts of Alaska have a moderate climate and very heavy

precipitation (over 160 in. a year in some places). The vegetation is remarkable chiefly for great coniferous forests, composed of Sitka Spruce (*Picea sitchensis*), Western White Cedar (*Chamaecyparis nootkatensis*), Western Hemlocks (*Tsuga heterophylla* and *T. mertensiana*), and further south the Lodgepole Pine (*Pinus contorta*), Fir (*Abies amabilis*) and Western Arborvitae (*Thuja plicata*). The trees are in dense stands and grow to a great size. The ground cover is a heavy mat of mosses and there is commonly a thick undergrowth of *Oplopanax horridum* and species of *Vaccinium*, *Rubus* and *Menziesia*. The forests of the interior are much more open in character, and composed of White Spruce (*Picea glauca*), Birch (*Betula papyrifera*), Aspen (*Populus tremuloides*), Lodgepole Pine (*Pinus contorta*) and a few other species. In places the forest consists only of *Picea glauca*, sometimes interspersed with grassy meadows.

Fires have been of widespread occurrence in both the distant and the recent past. In general, Pine and Aspen are 'fire trees' and do not reproduce themselves after a single generation following fire. Their abundance and size in relation to the Spruce in any given stand are, therefore, a rough guide to the recent fire history of the stand.

The only timber of much commercial value along the Alaska Highway is on the river flood plains and some of the foothill slopes. White Spruce grows to a height of 100 ft. or more with 18 to 24 in. d.b.h. on the flood plains, and the Alpine Fir and Spruces attain similar dimensions on the foothills.

12.19 : 12.25 (78.8). BAKER, F. S., and HALLORAN, A. F. **Occurrence of Corkbark Fir in Central Colorado.** *J. For.* 43, 1945 (680). [Univ. of California.] [1108].

Specimens of Corkbark Fir (*Abies arizonica*) were found in 1936 in central Colorado at an elevation of about 10,000 ft. associated with the more numerous Alpine Fir (*Abies lasiocarpa*). This is an extension both north and east of the hitherto recorded range of the species in Colorado. The trees are utilized locally as mine props.

12.19 : 12.26–8 (43.9). KÁRPÁTI, Z. Dendrologische Notizen. **[Dendrological notes.]** *Borbásia* 1 (3/7), 1939 (100–5). [G.] Biol. Abstr. 18 (22484). [1109].

Distribution notes on 7 species, including: *Genista ovata* ff. *eu-ovata*, *lancifolia* and *obtusata*, *Euonymus europaea* var. *borbásiana*, and *E. verrucosa* f. *transsilvanica*, all from Hungary.

12.19 : 12.26–8 (71.1). GLENDENNING, R. **The Garry Oak in British Columbia: an interesting example of discontinuous distribution.** *Canad. Field-Nat.* 58, 1944 (61–5). L.S. [1110].

The Garry Oak (*Quercus garryana*) is the only species of *Quercus* occurring naturally in British Columbia. The author describes its general distribution in the Province and discusses two records from Yale, B.C. (nearly 100 miles from the main area of distribution), and in the Quatsino Sound area. The latter record could not be verified, but the author's enquiries on Oak distribution led to the location of a previously unrecorded isolated colony of Oaks on Sumas Mountain, near Chilliwack. It is suggested that seed dispersal by the band-tailed pigeon (*Columba fasciata*) may be responsible for the inception of these Oak colonies away from the main area of distribution.

12.19.2. *Forest Types*

12.19.2 (43.1–5). ISSLER, E. Die Pflanzenwelt der Hochvogesen mit besonderer Berücksichtigung der Waldverhältnisse. **[The plant world of the High Vosges with particular reference to forest conditions.]** *Allg. Forst- u. Jagdztg.* 120, 1944 (59–66). [G.] [1111].

The Vosges mountains are mainly forested. Up to an altitude of about 500 m. the main type is Oakwood; from about 500 to 1,000 m. it is Beech/Fir. According to the usual succession of zones, this should be followed by Spruce, but, in fact, the upper slopes right to the summits are again occupied by broadleaved forest in the shape of Beech stands, which become progressively thinner and more stunted until, at the summit of the mountains, they are mere bushes. Spruce forms only about 8 per cent. of coniferous forest and most of it occurs in young plantations. The evidence of pollen analysis goes to show that Spruce has never been a dominant species in the Vosges. The reason why it has not been able to compete with Beech is probably the great force and persistence of the winds in this district. The great wind resistance of the Beech may be observed on exposed ridges from the Carpathians to the Pyrenees and including the Vosges

on sites which would appear otherwise to be eminently suitable for Spruce.

12.19.2 (469) : 12.26–8. CARVALHO, J. M. DE and FLORES, F. Contribuïção para o estudo dos carrascáis da região do centro litoral. [**Contribution to the study of the Oak thickets of the central littoral region.**] *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (452–3). [Port.] E.M.B. [1112].

A comparative phytosociological study of Oak thickets in Portugal, known locally as 'carrascais' on account of the dominance or abundance of the Carrasco (*Quercus coccifera* L.). The authors discuss the way in which other vascular plants are associated with *Q. coccifera* and the biological aspects of the assemblage of plant associations in which this species predominates. The study is based on 15 detailed floristic inventories of the vascular plants found in each plot, although the analysis was confined to a short period of the year. A comparison is made between the *Cocciferetum lusitanicum* and the *Quercetum galloprovinciale*.

12.19.2 (47.8) : 12.25 : 45.3 : 13.2. IL'INSKI, A. P. Sezonnaya dinamika lesnykh biotsenozov. [**Seasonal dynamics of forest biocoenoses.**] *Sovetsk. Bot.* No. 4/5, 1944 (32–45). [Russ.russ.] O.B.D. [1113].

The stands examined about 30 km. west of Kazan had a tree layer dominated by Pine, with individual Spruce locally in the pole stage, and in process of rapid natural thinning accompanied by increases in saprophytic fungi, xylophagous insects, and birds (especially woodpeckers) and by the development of underwood and a grass/shrub layer.

Spruce, here chiefly the hybrid complex '*Picea uralensis*' with some typical *P. obovata* and *P. abies*, is unable to replace Pine on the sandy soil of this district, since it grows less rapidly, fails to colonize well illuminated mineral substrates, and suffers badly from windthrow and periodic insect attacks.

Pine was severely damaged in 1942 and 1943 by mass attacks of *Bupalus piniarius* and is likely to form open stands in future. The most energetic colonists under Pine are the hemicryptophytes, with *Calamagrostis arundinacea* dominating, and these have a high frequency throughout the growing season. The geophytes *Convallaria majalis* and *Polygonatum officinale* have a short growing season and are scarcely evident towards autumn. There was a positive correlation between the frequency of *Fragaria vesca* and that of *Achillea millefolium, Antennaria dioica, Carex ericetorum, Scabiosa arvensis*, and *Pulsatilla patens*; and a strong inverse correlation between the same and that of *Pyrola chlorantha, Solidago virga-aurea*, and *Dicranum undulatum*.

12.19.2 (485) : 12.25 : 11.48 : 23.1. ARNBORG, T. Granberget. En växtbiologisk undersökning av ett sydlappländskt granskogsområde med särskild hänsyn till skogstyper och föryngring. [**Granberget. A plant biological study of a Spruce forest area in southern Lappland with particular reference to forest types and regeneration.**] [*Publ.*] *Norrländskt Handbibliotek, Uppsala* No. 14, 1943. pp. 282 + plates. [Sw.g.] Price 6 kr. [1114].

Granberget, a forest estate of 4,120 ha., lies near the southern boundary of Västerbotten at an altitude of 400–630 m., i.e. near the limit of Spruce forest, on high-level moraines. The soils are mostly podzolized, varying with humidity from iron podzols to humus podzols; the humus cover, usually about 5 cm. in total thickness, consists for the most part of a tough felted 'förna' which either lies directly on the mineral soil or is separated by a thin layer of raw humus. There was considerable variation in the depth of the bleached layer. The forests are chiefly Spruce with some admixture of Birch, and locally Pine, the latter dominating in a few areas. The Spruce is often attacked by woodrots, and the commonest wood-rotting fungi of the area are *Polyporus pini, P. pinicola* and *P. borealis*. Much attention was given to virgin growth of Spruce and it is noteworthy that there was no trace of forest fires in such areas, typically consisting of open woodland with large gaps between the isolated trees or groups. The vegetation is described in detail by layers. In the field layer the following major communities were recognized:—*Empetrum hermaphroditum/Vaccinium myrtillus* union; *Vaccinium myrtillus* union; *Rubus chamaemorus/Vaccinium myrtillus* union; *Thelypteris dryopteris/Vaccinium myrtillus* union; *Equisetum sylvaticum* union; *Geranium sylvaticum/Vaccinium myrtillus* union; and *Aconitum septentrionale* 'förbund' (nomenclature of Rietz). The moss layer is divided into the following unions:—*Cladina/Pleurozium schreberi*; *Ptilium crista-castrensis/Hylocomium splendens*; *Sphagnum robustum*;

Rhytiadelphus triquetrus; and *Mnium rugicum*. The forest types recognized are subdivisions by soil moisture (dry, fresh, moist, wet) of the following classes representing nutrient resources (poor, good, rich, and very rich): dwarf shrub type; *Dryopteris*/dwarf shrub type; dwarf shrubs and herbs or sedges; and herb type. The 'dry' class is represented only by the dwarf shrub type on poor soil. These forest types correspond approximately with combinations of the communities of the field and moss layers. Results are quoted from some preliminary investigations of the relation between vegetation and soil factors. No correlation could be established between snow cover and vegetation. Regeneration of Spruce varied with forest type, and the number of older seedlings was greater on the 'rich' types, but in general regeneration was very poor. In spite of the occasional production of viable seed in abundance and the prevalence of young seedlings after seed years, the establishment of the plants is largely prevented by unfavourable types of humus cover and by severe competition from the tree layer and soil vegetation. Of species in the field layer, *Deschampsia flexuosa*, particularly after clear felling in the 'fresh dwarf-shrub type', may completely prevent regeneration. On dense carpets of the mosses *Pleurozium schreberi* and *Hylocomium splendens*, germination takes place in moist periods but the roots of seedlings usually dry out before penetrating the loose upper humus layers. Liverworts and *Dicranum fuscescens* are more favourable for seedling establishment. Decaying stems of fallen trees also play an important part in regeneration and some established seedlings are usually to be found in the holes left by upturned root systems. Vegetative reproduction by layering is also common in the virgin stands. The open nature of the old stands is due to the relatively poor soils in combination with poor regeneration, and in the author's view good regeneration could only be achieved by reducing competition by burning or some other means of soil preparation.

12.19.2 (489). SISSINGH, G. Über einige Waldgesellschaften der Insel Seeland (Dänemark). Beitrag zur Kenntnis der regionalen Verbreitung einiger Waldassoziationen. **[Some forest communities of the Island of Seeland (Denmark). Contribution to the knowledge of the regional distribution of some forest associations.]** *Meded. LandbHoogesch. Wageningen* 45 (2), 1941. pp. 30. [G.] A.P.B. [1115].

Contrary to the assumption already expressed in literature that the vegetational climax of the Danish islands consists of a *Fagetum*, the climax appears rather to be a mixed Beech forest which in its floristic composition resembles the fern/Beech mixed forest (*Querceto-Carpinetum asperuletosum, Dryopteris* variant). In somewhat richer and possibly more recent soils this community is replaced by a variant rich in shrubby species which corresponds to the damp mixed Beech forest (*Querceto-Carpinetum asperuletosum, Sanicula* variant).

The greater part of the Danish forests consists of a *Querceto-Carpinetum asperuletosum*, the *Querceto-Carpinetum filipenduletosum* being found only in very small relicts on damp soils. Its former habitat has now been almost everywhere converted into arable land or meadows.

The *Querceto-Betuletum violetosum riviniianae* has arisen through the degradation of the *Querceto-Carpinetum asperuletosum*. The first named community is found particularly on forest edges which have been thinned out by wind.

In peaty soils in the valleys, the original vegetation was Birch swamp (*Betula pubescens*/*Vaccinium uliginosum* associations), a forest community allied to the *Vaccinio-Piceion*. The latter has, however, almost completely died out owing to improved drainage. In its place on the drained peat soils we find damp Oak/Birch forest (*Querceto-molinietosum*) or artificial Spruce plantations. *From author's summary.*

12.19.2 (54.87) : 11.4 : 12.19.3. ROSAYRO, R. A. DE. **The soils and ecology of the wet evergreen forests of Ceylon.** *Trop. Agriculturist, Ceylon* 98 (2; 3), 1942 (4–14; 13–35 + plates). L.S. [1116].

Part I of the article gives a general survey of the situation, climate, and geology, with a classification of soils, of the wet evergreen forest region of Ceylon, while part II deals specifically with ecology and forest types. The vegetation is usually divisible into several well marked layers: (1) the tree layer consisting generally of a dominant tier of tall trees (including deciduous species) and a subdominant tier of exclusively evergreen species; (2) the shrub layer, usually divisible into tall and low shrub layers, and (3) the ground flora, consisting of grasses, ferns, herbs and mosses. There are two flowering and fruiting

seasons, roughly from March to June and from October to December, the former being the more important for regeneration.

From one-per-cent. enumerations carried out in connexion with working-plan investigations, the author distinguishes the most important communities of tree species. These communities, and the corresponding communities of the shrub and ground layers, are considered together and related as far as possible to site (generally soil) conditions. Plant lists of important species, with indications of their relative frequency, are given for each of the chief communities.

Four important high-forest communities are described: (1) the *Dipterocarpus* community; (2) the *Mesua/Doona* community; (3) the *Campnosperma* and other species community; and (4) the *Vitex/Wormia/Chaetocarpus/Anisophyllea* (*Dillenia*) community. Two minor low-jungle communities are also described. Briefer descriptions are given of scrub jungle, fernland and grassland communities.

A tabular summary shows the position of each community with regard to soils, undergrowth, regeneration and ecological status.

There are maps of regional distribution, and rainfall zones, graphs of average monthly rainfall at 12 stations, soil profiles in 23 diagrams and a series of photographs.

12.19.2–3 (77.1) : 01.3. SOCHAVA, V. E. Opȳt filotsenogeneticheskoy sistematiki rastitel'nȳkh assotsiatsi. **[Attempt at a phylocoenogenetic classification of plant associations.]** *Sovetsk. Bot.* No. 1, 1944 (3–18). [Russ.] O.B.D. [1117].

An attempt to apply 'phylogenetic systematics' to the taxonomy of vegetational communities in the Amur and Maritime regions of the Far East.

Three major vegetation types are recognized: (1) Nemoral: with one 'fratia'—the Manchurian. (2) Boreal: with two 'fratiae'—the Bering (*Microbiota*, dwarf Siberian Pine and *Betula ermanii*) and the Angar (Dahurian Larch and Birch scrub). (3) Tundra: comprising formations of the mountain-tundra 'fratia'.

The detailed subdivision of a 'fratia' is illustrated by a discussion, on the basis of their probable developmental history since the Tertiary period, of the formation-classes under the Manchurian 'fratia' and of the formations under one of these classes in the Manchurian mixed forest formation-class.

The formation-classes of the Manchurian 'fratia' are all considered to have arisen by differentiation from one ancient Manchurian mixed proto-formation along two main lines—xerophytic and mesophytic. Two xerophytic formation-classes—the Manchurian Pine (*Pinus funebris*) woods and herbaceous xerophytes—are believed to be of the most ancient origin. Further differentiation proceeded within the mesophytic branch, partly in response to increasingly xerophytic and psychrophytic tendencies. The Amur-Hokkaido dark-leaved coniferous forest (*Picea jezoensis, Abies nephrolepis*) was the next formation-class to be split off; its chief characteristic is structural and floristic impoverishment with selection of cold-resistant species. Subsequently, but at about the same time, there arose the formation-classes of Manchurian Oak woodland (*Quercus mongolica*), whose development was hastened by biotic factors; Manchurian meadowland; and Manchurian scrub (Hazel, Lespedezas, *et al.*). The two latest formation-classes are (*a*) the Manchurian White Birch forest, largely composed of secondary associations which have arisen in comparatively recent times from (*b*) the Manchurian mixed forest.

The Manchurian mixed forest is considered to show the nearest existing parallel to the mixed forest of the Tertiary period. It is subdivided into 8 formations arranged in putative order of origin:—(i) Fir (*Abies holophylla*)/hardwood forests; (ii) Siberian Pine/hardwoods with Hornbeam (*Carpinus cordata*). Both of these are of storeyed structure and contain many thermophilous species as relicts from warmer and more humid times. (iii) Siberian Pine/hardwoods with Oak; (iv) Siberian Pine forest, a psychrophytic type; (v) Siberian Pine/hardwood with Ash, Elm and Poplar, a valley type developed in adaptation to greater cold and lower humidity. (vi) Hardwood forest with Ash and Elm, possibly a secondary type derived from the last-named at lower levels. (vii) Hardwood forest with Lime and Yellow Birch (*Betula lutea*), which is regarded as a late secondary derivative of (viii) Siberian Pine/hardwood forest with Lime and Yellow Birch, a type developed under similar conditions to (v), but in interfluvial tracts.

The phylogenetic relationships of these formation-classes and formations are illustrated by two diagrams.

It is claimed that the application of the

phylogenetic concept results in a more natural system of ecological units, and as stress is laid on origin together with geographical criteria, 'lumping' of communities in widely different countries by life-form and generic affinities of the dominants, or by these in combination with edaphic factors, is avoided.

12.19.2 (79.8) : 33 : 98.1. BLACKERBY, A. W. **Opportunities for minor wood product industries in Alaska.** U.S. Forest Service, Alaska Region. 1945. pp. 20. P.R. [1118].

This pamphlet describes the commercial timber resources of Alaska, discusses the logging and sawmill industries, and gives examples of small wood-using industries particularly adaptable to the Territory.

Alaska's forests are of two distinct types: the coast forest which is coniferous and similar to that on the coasts of Oregon, Washington and British Columbia, and the interior forest which is a woodland type occupying the greater part of the large central plateau. The coast forest is mostly included in the National Forests of Alaska. It consists mainly of heavy, dense stands of Western Hemlock (*Tsuga heterophylla*) and Sitka Spruce (*Picea sitchensis*). Western Red Cedar (*Thuja plicata*) and Alaska Cedar (*Chamaecyparis nootkatensis*) are frequently associated with the two principal species, and any of the four may occur as a small pure stand. In the usual mixed stand Hemlock with some Cedar forms a dense main stand, overtopped by trees of the more light-demanding Sitka Spruce; bushy saplings of Hemlock, Cedar and various shrubs form a very dense understorey. The commercial forest extends from the edge of tide water to about 1,500 ft. elevation; good timber rarely extends more than 5 miles inland and about 75 per cent. of usable timber lies within 2½ miles of tide water.

The interior forests are of great local value but do not compare in commercial importance with the coastal forest. They resemble the forests of Maine and eastern Canada both as to mixture and species. Rough estimates indicate an area of 65–80 million acres bearing timber suitable for local use, with a volume of at least 3,500 bd. ft. per acre, which gives a total volume of not less than 225 billion bd. ft. The most prevalent type is a mixture of White Spruce (*Picea glauca*) and Alaska White Birch (*Betula neoalaskana*) with some Aspen (*Populus tremuloides*) and Balsam Poplar (*Populus tacamahaca*).

The bulletin gives some account of the habit and properties of the commercial species and of logging and sawmilling in Alaska.

12.19.4. *Succession*

12.19.4 (729.6) : 23.4. BEARD, J. S. **The progress of plant succession on the Soufriere of St. Vincent.** *J. Ecol.* 33, 1945 (1–9 + plates). [1119].

The vegetation of the Soufriere mountain in St. Vincent, British West Indies, was destroyed by an incandescent avalanche in the eruption of 1902–3, and the mountain was subsequently covered by a layer of fresh volcanic ash. Plant colonization of the bare ground began as soon as the mountain cooled, and succession is still in progress. The contemporary vegetation was described by W. N. Sands in 1912. The writer visited the mountain in 1942 and found that plants had established themselves right to the summit and also inside the crater. Growth varies from a high forest at the base of the mountain to a moss-and-lichen tundra at the top.

Certain communities found at the upper levels simulate in physiognomy climax formations such as elfin woodland, alpine meadow and tundra, though the floristic composition in any example is not that of the climax, and the simulated climax is made to appear far below its proper altitude. When the mesophyte communities of any series of habitats are interfered with or destroyed, the moisture relations of the environment are temporarily made more adverse, and if the original soil is buried beneath a layer of volcanic ashes, the environment deteriorates still further. The earlier stages of succession will therefore tend to resemble climax types of greater adversity within the same group or series. If elfin woodland is totally destroyed by a volcanic eruption, the first community colonizing the new ground is one resembling the most extreme montane climax, i.e. tundra; the tundra-like stage is gradually replaced by one resembling alpine meadow, and finally the climax elfin woodland reappears. This succession is taking place on the Soufriere.

This generalization of succession applies only to the communities of adverse environment. In general, high forest grows back directly by stages which are proper to it, do not resemble

any climax types, and are determined first by seed dispersal and then by light requirements. The principal components of evergreen tropical forests seem often to be silviculturally shade-demanders in their youth. Not only do they tolerate shade, but they seem to need it for successful establishment and growth. The first tree species to arrive in succession are a light-demanding group not belonging properly to the climax association, with seed either light and carried far by wind (*Ochroma*) or distributed by bats (*Cecropia*) or by birds (*Freziera, Guazuma*). These species have a thin foliage and cast only light shade. Beneath them comes in a group of components of the climax association having high light requirements. These, of which in the lesser Antillean montane zone the principal are various Lauraceae, *Simaruba amara, Hieronyma caribaea, Pithecolobium jupunba, Sapium caribaeum,* and *Chimarrhis cynosa,* grow up beneath the light canopy of the first arrivals and form a canopy under which the real shade-demanders will come in and reintegrate the climax association. The high forest now covering the lower levels of the Soufriere is evidently well advanced in the *Ochroma/Cecropia/Freziera* stage and is ripe for the arrival of members of the climax *Dacryodes/Sloanea* association. Delay is possibly due to the distance of several miles from the nearest seed trees.

12.2. *Special (Systematic) Botany*

12.21. Fungi

12.21 : 44.3 : 12.26–8. LIMBER, D. P., and CASH, E. K. ***Actinopelte dryina.*** *Mycologia* 37, 1945 (129–37). [U.S. Bureau of Entomology and Plant Quarantine, Hoboken, N.J.] L.S. [1120].

A discussion on the synonymy of *Actinopelte dryina* (Sacc.) Hoehn., a fungus associated with leaf spots of Oak and other deciduous trees. Because of incomplete or erroneous data given in various accounts of this fungus an emended description based on the examination of recent collections and numerous herbarium specimens is included in this paper.

12.21 : 31.42.12 : 12.26–8. DAVIDSON, R. W. **Two American hardwood species of *Endoconidiophora* described as new.** *Mycologia* 36, 1944 (300–6). [U.S. Bureau of Plant Industry, Soils, and Agricultural Engineering.] L.S. [1121].

The common American hardwood-staining species of *Endoconidiophora* previously referred to *E. coerulescens*, a conifer fungus, is shown to be a distinct species and described as *E. virescens*. Another related species causing grey mould on Chestnut Oak tanbark is described under the name *E. variospora*.

12.21 (54.1) : 31.42.11. BANERJEE, S., and BAKSHI, B. K. **Studies in the biology of wood-rotting fungi of Bengal.** *J. Indian bot. Soc.* 24, 1945 (73–93 + plates). [Department of Botany, Calcutta Univ.] O.B.D. [1122].

An account of the life history and cultural characters of six wood-rotting polypores of Bengal: *Polyporus brumalis, P. friabilis, P. rubidus, P. ochroleucus, Polystictus steinheilianus,* and *Merulius similis*. After a general introduction on cultural methods and conditions of growth, the authors consider each fungus separately with regard to its geographical distribution, host plants, and growth in culture (habit of growth, colour, rate of growth, sporophore production, and mycelium). The influence of several external factors (including light, temperature, substratum, aeration, humidity and gravity) on vegetative growth and sporophore formation in artificial cultures of these fungi is indicated.

12.21. BISBY, G. R. **Longevity of *Schizophyllum commune*.** *Nature, Lond.* 155, 1945 (732–3). [Imperial Mycological Institute, Kew, Surrey.] [1123].

A number of whole or part pilei of the xerophytic agaric *Schizophyllum commune* were sealed in glass tubes in a vacuum of less than 0·1 mm. pressure of mercury in December, 1910 (15 months after they had been collected) and stored in the dark at room temperature. Four of the tubes were opened in March, 1945, the pilei after being moistened expanded and shed spores, a number of which germinated when placed in water or on agar. Eleven of the vacuum tubes remain for future tests.

12.26-8. Dicotyledons

12.26–8 (63) : 12.19.1. CHIOVENDA, E. **Plantae novae aut minus notae ex Aethiopia.** *Atti (Mem.) Accad. Ital.* 11 (2), 1940 (17–67). [It.] [1124].

A description of 60 new or little known species and several varieties from Abyssinia, in continuation of earlier articles in Series 6 of

the R. Accademia dei Lincei. The tree species re-characterized are *Trichilia siderotricha* Chiov., *Ximenia americana* L., *Cassia ruspolii* Chiov., and the new species described by Chiovenda are *Combretum marchettii*, *C. cyclocarpum*, *Pouteria ferruginea*, *P. giordani*, *P. rufinervis*, *Manilkara butugi*, *Mimusops stenosepala*, *Olea mussolinii*, and *Macaranga lophostigma*.

12.26–8 (86). CUATRECASAS, J. Notas a la flora de Colombia, VI. **[Notes on the flora of Colombia, VI.]** *Rev. Acad. Col. Cienc. exact. fís. nat., Bogotá* 6 (21), 1944 (32–67). *Abstr.* in *Trop. Woods* No. 83, 1945 (22). [1125].

The author describes one new genus (*Neocaldasia*, family Compositae), 43 new species, two new varieties, and one new form. Of the species 32 belong to the Compositae: *Senecio*, 23; *Gynoxys*, 5; *Liabum*, 2; *Neocaldasia*, 1; *Culcitium*, 1. One new species each is listed for *Theobroma* (Sterculiaceae), *Hypericum* (Guttiferae), and *Puya* (Bromeliaceae); two for *Quercus* (Fagaceae); four for *Cecropia* (Moraceae); two for *Mayna* (Flacourtiaceae).

12.26–8 (48). LINDQUIST, B. *Betula callosa* **Notö, a neglected species in the Scandinavian subalpine forests.** *Svensk bot. Tidskr.* 39, 1945 (161–86). [E.] O.B.D. [1126].

The author describes the re-discovery of *Betula callosa* in the upper parts of the subalpine Birch region in an area extending from the upper tree limit some 200 m. vertically down the mountain slopes, and gives an emended Latin diagnosis of the species. *B. callosa* is found most often in hybrid form, and occurs as a pure species only in minor shrubs or in the form of single trees. It easily forms hybrids with *B. tortuosa*, *B. coriacea* and *B. nana*.

The species shows striking similarities with the East Asiatic Birch, *B. ermanii*, and with *B. murithii* and *B. raddeana* from western Eurasia. Taxonomically *B. callosa* most nearly resembles *B. raddeana*, and it is suggested that these two species should be included in a new section of their own, to which the author gives the name *Nivales*, and in which the leaves and twigs characteristic of the section *Albae* are combined with catkins and catkin scales characteristic of the section *Costatae*. The genus *Betula* would thus consist of the following five sections: *Betulaster*, *Albae*, *Nanae*, *Nivales* and *Costatae*.

12.26–8 (79.8). NELSON, A. **Rocky Mountain Herbarium studies. VI.** *Amer. J. Bot.* 32, 1945 (284–90). [Univ. of Wyoming, Laramie, Wyo.] O.B.D. [1127].

A paper containing notes on miscellaneous species collected mainly from Mt. McKinley National Park, Alaska, in 1939. Among the plants listed is a new tree species, *Betula beeniana*, found in a grove of trees on a ridge hillside in open Spruce woods. The new species resembles *B. glandulosa* in leaf and twig characters but not in size or fruit characters. It is possibly the same plant as that listed by Edith Scamman as *B. ermanii* × *glandulosa* in her 'Plants from interior Alaska' (*Rhodora* 42, 1940 (321)).

12.26–8 (82) : 12.19. CASTELLANOS, A. Contribución a la flora de San Luis. II. El Guayacán del Bajo de los Vélez. **[Contribution to the flora of San Luis. II. The guayacán of the Vélez basin.]** *Lilloa* 10, 1944 (433–44 + plate). [Span.] A.P.B. [1128].

Caesalpinia melanocarpa occurs sporadically in the north of the Province of San Luis. The author discusses the species and its place in the Argentine flora and cites records of its distribution.

12.26–8 (81). TOLEDO, F. J. *Vernonia* et *Verbesinae* novae brasiliensis. **[New Brazilian species of *Vernonia* and *Verbesina*.]** *Arq. bot. S. Paulo* 1 (4). *Abstr.* in *Trop. Woods* No. 83, 1945 (17). [1129].

Descriptions are given of one new species of *Vernonia* and three of *Verbesina*.

12.26–8 (81). HOEHNE, F. C. Uma nova Elaeocarpacea de São Paulo. **[A new species of the Elaeocarpaceae from São Paulo.]** *Arq. bot. S. Paulo* 1 (4), 1942 (93–4). *Abstr.* in *Trop. Woods* No. 83, 1945 (17). [1130].

Sloanea fernando-costae Hoehne is the new species described.

12.26–8. REHDER, A. ***Carya alba* proposed as *nomen ambiguum*.** *J. Arnold Arbor.* 26, 1945 (482–3). [1131].

12.26–8 (82). SANTOS BILONI, J. Plantas de nuestra flora: los laureles. **[Plants of our flora: the 'Laurels'.]** *Suelo argentina* 4, 1945 (382–3, 387). [Span.] A.P.B. [1132].

General characters of the Lauraceae, and specific characters of the Argentine species:

Phoebe porphyria, *Nectandra membranacea* var. *falcifolia*, and *Ocotea acutifolia*.

12.26–8 (728 : 8). GLEASON, H. A. **On *Blakea* and *Topobea*.** *Bull. Torrey bot. Cl.* 72, 1945 (385–93). O.B.D. [1133].

Blakea and *Topobea* differ only in their floral characters, and there has been ample opportunity to refer herbarium specimens to the wrong genus.

The coastal forests of western Colombia and the adjacent slopes of the Cordillera Occidental have more species of the two genera than any other region and may well be regarded as their centre of distribution. The annotated list of *Blakea* and *Topobea* species given in the present paper is based on collections made by Dr. Cuatrecasas in western Colombia. Among the new tree species described by Gleason are *Blakea clusiifolia*, *B. cuatrecasii* and *Blakea platypoda*.

12.26–8 (86). GLEASON, H. A. **Some Melastomaceae of Colombia.** *Bull. Torrey bot. Cl.* 72, 1945 (472–9). [New York Botanical Garden, New York.] O.B.D. [1134].

Among the Melastomaceae described by Gleason in this paper are the following new tree species: *Conostegia rubiginosa*, *C. cuatrecasii*, *Miconia calcarata*, *M. transversa*, and *M. centronioides*.

12.26–8. BARRETT, M. F. ***Ficus altissima*.** *Bull. Torrey bot. Cl.* 72, 1945 (394–8). O.B.D. [1135].

The author gives botanical descriptions of *Ficus benghalensis* L. and *F. altissima* Blume, two occasionally confused species which may show the banyan habit, and discusses the synonymy of *Ficus altissima*. A brief description of *F. altissima* var. *fergusonii* King is appended. This variety is native to Ceylon.

12.26–8 (81). HOEHNE, F. C. Uma nova espécie de Opiliaceae do Jardim Botânico de São Paulo. [**A new species of Opiliaceae from the São Paulo Botanic Garden.**] *Arq. bot. S. Paulo* 1 (6), 1944 (136–7). *Abstr.* in *Trop. Woods* No. 83, 1945 (18). [1136].

Agonandra engleri is separated from *A. brasiliensis* and described as new.

12.26–8. FLODERUS, B. ***Salix crataegifolia* Bertol.** *Svensk bot. Tidskr.* 38, 1944 (64–8). [E.] O.B.D. [1137].

Salix crataegifolia is one of the rarest and least known of the European *Salix* species. Its taxonomic status has long been disputed, but in the author's opinion it represents a valid and well differentiated species of the *Nigricantes* group, its nearest relative probably being the Siberian *S. jenisseensis*. The species is described, with notes on its synonomy and habitat.

12.26–8. FLODERUS, B. ***Salix heterostemon* Floderus, sp. nov.** *Svensk bot. Tidskr.* 38, 1944 (69–72). [E.] O.B.D. [1138].

A botanical description is given of the new species *Salix heterostemon* discovered in 1933 in the highlands of south-eastern Tibet by the British explorer, Kingdon-Ward. The species holds a decidedly isolated position in the Salicaceae, and its right to be included in the genus *Salix* may be disputed. Its closest relative is perhaps *S. angiolepis* Seveillé from China.

13. FOREST ZOOLOGY

13.2. *Special [Systematic] Zoology*

13.2 (94). MATHEWS, G. M. **List of birds of the Australian Capital Territory.** *Leafl. Commonw. For. Bur. Aust.* No. 53, 1943. pp. 8. [1139].

This list of birds found in the Australian Capital Territory gives their scientific and common names and some indication of habitat and abundance.

13.2. SAEGER, H. DE. Les *Apanteles*, Hyménoptères, Braconides, parasites de Lépidoptères. [**The *Apanteles* (Hymenoptera, Braconidae), parasitic on Lepidoptera.**] *Bull. agric. Congo belge* 33, 1942 (234–88). [F.] [1140].

Of the 78 Ethiopian species of *Apanteles* 48 have been recorded from the Belgian Congo. The paper gives a general account of the genus, with the group characteristics (after Wilkinson), the morphology of the adult and larval stages, biology, life history, epiparasitism, biogeography and synecology. The Ethiopian species are tabulated with hosts (42 identified), species of plants attacked by the hosts, and geographical distribution. The food plants of the hosts include several species of tropical African trees.

2. SILVICULTURE

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.0. *Adaptability to the General Environment. Acclimatization*

21.0 (41.5) : 12.25 : 2 : 31.0. McMahon, F. **Sitka Spruce in Irish forestry.** *Irish For.* 2, 1945 (66–71). [1141].

The Sitka Spruce (*Picea sitchensis*) was first introduced into Ireland as an ornamental tree about 80 years ago. Except for an experimental plot at Avondale, planted about 1905 or 1906, Sitka Spruce appears not to have been used in plantations before 1909. Notes are given on its natural habitat, nursery treatment and subsequent tending. The species is well adapted to a wet climate and, owing to its great wind resistance, is suited to bleak mountain slopes and sites near the sea. As long as there is sufficient moisture in the soil, Sitka Spruce is very accommodating, but it will not grow on waterlogged soil or on one deprived of air by a tight peat skin. Where there is any doubt about excessive moisture in the soil, it is advisable to plant Sitka Spruce on turfs, which is much cheaper than carrying out extensive drainage. Being a shallow rooter, it thrives well when planted in this way, whereas when planted deeply in pits, the roots usually die or the plants remain in a state of check until a new root system develops from the collar.

Sitka Spruce suffers from frost damage when young, and may remain in a state of check for a number of years until the plants get above the frost line and growth becomes normal. In cases where frost pockets are recognized or suspected, Grey Alder should be planted two or three years before the ground is stocked with Sitka Spruce.

Height growth is normally 2 to 2½ ft. per annum, but sometimes as much as 3 or even 4 ft. At Pettigo State Forest in Co. Donegal there are extensive young plantations of Sitka Spruce on difficult moorland soil consisting of a deep, waterlogged peat, mostly between 400 and 700 ft. above sea level. The vegetation was mainly *Molinia* on the planted areas, with occasional rushes and bog myrtle. Planting was begun in 1937 and was all done on turfs at a spacing of 4½ × 4½ ft. The tallest of the trees are now 20 ft. high, but height growth is not uniform, and some years must elapse before the stands reach thicket stage. Thinning should commence when the trees are 25 ft. high and should be continued at intervals of 3 years. The grade of thinning suggested is one in which many of the weaker dominants are removed, as well as whips, injurious wolf trees, and any suppressed or subdominant trees not required for ground cover. Some figures are given for yield and rate of growth from some Sitka Spruce stands in Ireland, and a short description of the timber and its uses.

21.0 (73) : 12.26–8. Smith, J. R. **The Chinese Chestnut as a timber tree.** With comment by H. W. Olds. *For. Leaves* 35 (2), 1945 (13–4). [1142].

The article attacks the general idea that the Chinese Chestnut (*Castanea mollissima*) is a poor timber tree and cannot compete with natural growth in an American forest, and advises the import of seed specially selected from wild trees in China, as all seed hitherto brought to America has been the large-sized seed of horticultural production which is at a disadvantage for use in forestry. The blight resistance and rapid growth of *Castanea mollissima* in the United States are strong reasons for seeking to establish it.

In his comment Mr. Olds states that the Ohio Conservation Authority have been encouraging the planting of Chinese Chestnuts by farmers. They must be planted on a light, fertile soil as they cannot stand heavy, low, wet sites. Given the cultivation and fertilization of a Peach tree, they will bear in 3 to 5 years. Trees planted in recently-cut woodland do remarkably well, while on worn-out soils without cultivation they stand for 5 to 6 years before they start to grow. In such old-field areas, the planting of Black Locust (*Robinia pseudoacacia*) feeds the soil, stimulates Chestnut growth, smothers competing grass and weeds, and brings in an extra profit from the plantation.

21.0 (931). Yarham, E. R. **North American species thriving in New Zealand.** *B.C. Lumberm.* 29, 1945 (69–70). [1143].

Exotic tree species, mostly of North American origin, are of increasing importance in New

Zealand forestry. The annual cut of rough-sawn exotic Pine timbers rose from 4 million bd. ft. in 1918–19 to 56¼ million bd. ft. in 1941–42. The area of State forests at present under exotics is a little less than 450,000 acres. In addition, there are over 30 companies engaged in commercial afforestation with exotics, and they hold 370,000 acres for this purpose. A practice which is being increasingly followed is the interplanting of cut-over indigenous forests with suitable exotics, while the uncut forest is regenerating and coming to maturity. The main species now being planted in North Island are *Pseudotsuga taxifolia*, *Pinus ponderosa*, and *P. radiata*. *P. palustris*, *P. taeda* and *P. caribaea* have shown promising results in the Auckland Conservancy. In South Island, *P. ponderosa*, *P. laricio*, *P. radiata* and *Pseudotsuga taxifolia* are the principal species used. *P. radiata* is now the second most widely used timber tree, the first being the native species *Dacrydium cupressinum*; *P. radiata* is the most productive and fastest growing of introduced Pines and needs fewer cleanings than other species.

Extensive research has been made into the utilization of exotic timbers and a modern type of log-gang sawmill has been established for their manufacture.

21.0 (96.9) : 11.62.11. HAWAII. **Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii for the biennial period ended December 31, 1944.** Board of Agriculture and Forestry, Territory of Hawaii. 1945. pp. 115. [1144].

The trees, shrubs and ferns of the Hawaiian rain forests are closely dependent on one another. The destruction of the low cover by grazing animals means a gradual death of the high cover. The complete exclusion of such animals is necessary for the preservation of the valuable cover on watersheds (p. 16).

The Paper Bark tree (*Melaleuca leucadendron*) has shown remarkable tolerance and adaptability to a wide range of soil and rainfall conditions at elevations below 3,000 ft. On some, wet, acid soils it has seeded and produced heavy stands of young trees. This habit along with its vigorous growth makes it a desirable wet-forest tree and more than 1½ million trees of this species have been planted. The Silk Oak (*Grevillea robusta*) reproduces naturally on the dry slopes of leeward Kauai, North Kona and Kau. It is a valuable timber tree, which appears to reach maturity in about 40 years (p. 19).

The Turpentine tree (*Syncarpia laurifolia*) produces a very hard, oily wood, resistant to attacks by fungus and other rots when placed in contact with the ground. It grows well at elevations up to 5,000 ft. with moderate to heavy rainfall. Trees over 50 years of age show no reduction in vigour of growth. More than 50,000 trees of this species have been planted for fence posts and power-line poles.

The Brushbox (*Tristania conferta*) is also an oily hardwood of symmetrical trunk, and a valuable fence-post tree. It is adaptable to a wide range of elevations and is more tolerant of dry conditions than the Turpentine trees. More than 135,000 of this species have been planted (p. 21). The Blackwood (*Acacia melanoxylon*) is a healthy, vigorous species with straight, symmetrical trunks yielding fine hardwood timber suitable for interior finishing or cabinet work. At elevations of 3,000 ft. to 5,000 ft. with moderate rainfall it shows a vigour of growth not equalled by many species. It reproduces itself by sending up root shoots, which makes it particularly valuable for planting on gully sides. More than 15,000 of this species have been planted out (p. 37).

Conifers are foreign to Hawaii, but many species have been tried at different elevations. The Sugi (*Cryptomeria japonica*) does well at elevations over 3,000 ft. and more than 400,000 have been planted. The Redwood (*Sequoia sempervirens*) is doing well at elevations of 3,000 ft. and over in regions of moderate to heavy rainfall throughout the Territory (p. 39).

21.0 (96.9) : 12.25–8. BRYAN, L. W. **Experimental forest planting—Mauna Kea, Island of Hawaii.** *Hawaii Planters' Rec.* 48, 1944 (179–81). L.S. [1145].

The average growth of *Cedrus deodara*, *Libocedrus decurrens*, *Pinus coulteri* and *P. jeffreyi* introduced in 1909–10 to the Hawaiian mountain flora from the mainland and Australia compares favourably with the growth of these species under optimum conditions in their native habitats. Only *Eucalyptus robusta* survived out of the hardwood species introduced.

21.1. *Light and Temperature Requirements*

21.11 : 12.25 : 21.62 : 21.64. CHAPMAN, H. H. **The effect of overhead shade on the survival of Loblolly Pine seedlings.** *Ecology* 26, 1945 (274–82). [School of Forestry, Yale Univ.] [1146].

The survival and dominance of Loblolly Pine (*Pinus taeda*) seedlings, in competition with hardwood sprouts originating after cutting and fires, are assured by their more rapid height growth, provided the seedlings become established within one or two years, and do not meet competition with hardwood brush already established previous to cutting and remaining thereafter, in absence of fire.

The overhead shade of low hardwoods is fatal to Loblolly Pine seedlings. The average period required after initial shading, before death occurs, is a little over five years.

Under high overhead shade, with partial, intermittent sunlight, and in the absence of low competitive hardwoods, Loblolly Pine can survive as suppressed seedlings and small saplings for one or two decades, provided height growth exceeds six inches annually and severe droughts do not occur. In this condition the seedlings remain vulnerable to light surface fires at any season, by contrast to seedlings grown in open sunlight, which rapidly attain resistance to winter surface fires.

The plot data, on which these conclusions as to the effect of high shade were based, consisted of two contrasted series of ten $\frac{1}{100}$-acre plots, one of which was clear cut when the advance reproduction was from 8 to 15 years' old, and the other left as a check series. The results are compared after the fourth growing season.

The conclusions as to the effect of low shade were based on data from a plot measuring 30 by 120 ft. on which the position of each individual tree or seedling was mapped and its diameter breast high and total height measured annually for 12 seasons, beginning 8 years after the origin of the stand, which followed a crown fire. Mortality and height of survivors for both Pine and hardwoods are shown by years, and a prediction is made as to the ultimate composition of the stand.

The silvicultural treatment indicated in managing these mixed stands in order to secure Loblolly Pine rather than inferior hardwoods consists, first of clear cutting in areas large enough to permit the Pine seedlings to secure full sunlight, and second, the killing back of hardwood sprouts, at the time of cutting the mature timber, by winter burning, followed by exclusion of fire until the new seedling crop reaches fire-resistant dimensions in from 6 to 10 years. Single-tree selection as a system will tend progressively to bring about the substitution of inferior hardwoods for Loblolly Pine in the future stand. *Author's summary.*

21.12 : 12.26–8 (74.7). **Cedar seeds tested.** *Amer. Nurserym.* 82 (4), 1945 (15). [1147].

A test planting of *Libocedrus decurrens* (Incense Cedar) to determine its hardiness in the northeastern United States, made at the Soil Conservation Service nursery at Big Flats, N.Y., showed that the species would not survive winter conditions at the New York nursery and was probably not sufficiently hardy to survive field conditions. *Thuja orientalis* (Oriental Cedar) in adjoining seedbeds was hardy and exceptionally vigorous, producing excellent stock during the same period.

21.2. *Moisture Requirements*

21.2–3 : 12.25. FOWELLS, H. A., and KIRK, B. M. **Availability of soil moisture to Ponderosa Pine.** *J. For.* 43, 1945 (601–4). [California Forest and Range Exp. Sta., Berkeley, Calif.] [1148].

A greenhouse study was designed to determine the effect of loss of root tips and of amount of available water on the survival and growth of Ponderosa Pine, and to compare the apparent wilting points of Ponderosa Pine and sunflowers. Seedlings with mutilated root systems transpired less moisture for the first month than seedlings with intact root systems. The survival of seedlings with intact root systems was markedly better; these seedlings were able to become established and grow in soil with a moisture content only 2 per cent. above the wilting point. The growth of tops and roots of the surviving seedlings was practically equal for the two root conditions. Height growth of the seedlings was about proportional to the amount of soil moisture available and the amount of water transpired.

Ponderosa Pine seedlings, grown in the same containers with sunflowers, showed no signs of wilting when the sunflowers wilted at a soil moisture content of about 7 per cent. The

Pines survived even after they had reduced the soil moisture content to less than 4 per cent.

The results suggest two silviculturally important facts. Firstly, mortality of planted Ponderosa Pine may be due, not to climatic factors, but to the inability of the seedlings' root systems to absorb enough available moisture, because they have been severely damaged in handling and cannot regenerate new roots soon enough. Secondly, planted Ponderosa Pine, once it is established, is able to survive under soil-moisture conditions normally found in the field, even when the soil moisture content falls below the accepted wilting point.

21.3. *Soil Requirements*

21.3 : 12.26–8 : 23.24 : 64. AUTEN, J. T. **Some soil factors associated with site quality for planted Black Locust and Black Walnut.** *J. For.* 43, 1945 (592–8). [Central States Forest Exp. Sta., Columbus, Ohio.] [1149].

Large numbers of Black Locust (*Robinia pseudoacacia*) and Black Walnut (*Juglans nigra*) have been planted in the eastern and central United States with varying success, often on soils to which these species are not native. The study reported in this paper attempts to divide some plantation soils into simple classes and to correlate site indexes of the two species with easily recognizable soil properties. From this work it is concluded that for both species: (1) excessively dry soil and soil with slow drainage should be avoided; (2) clay and silty clay are not so desirable as are sandy loams, loams, and silt loams; (3) soil reactions between pH 4·6 and 8·2 may be disregarded; (4) lime-derived soils and soils without pronounced subsoil development are best; (5) yellow, brown, or reddish-brown subsoils without pronounced mottling are better than grey or yellow subsoils mottled with any colour.

Soil survey maps are recommended for use in evaluating sites.

21.3 : 12.26–8 (75.2). LATIMER, W. J., and DILLER, J. D. **Response of young Asiatic Chestnut trees on different soil types in Eastern Maryland.** *J. For.* 43, 1945 (510–2). [U.S. Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Md.] [1150].

Small experimental plantings made in eastern Maryland with 1–1 transplants of Asiatic Chestnuts, including 12 strains representing Chinese and Japanese Chestnuts (*Castanea mollissima* and *C. crenata*) and a few hybrids, show that their establishment and growth are greatly influenced by soil conditions, particularly water relationships. In general, their silvicultural requirements, particularly with reference to soil moisture, resemble those of Yellow Poplar (*Liriodendron tulipifera*).

21.6. *Behaviour in the Stand*

21.6 : 12.14.4 : 12.25 : 56.04. CAVIQUE SANTOS, P. E. Conseqüências da perda prematura da flecha em duas especies de resinosas. [**Consequences of the premature loss of the main shoot in two species of conifers.**] *Abstr. in Rev. agron., Lisboa* 30, 1942 (452). [Port.] E.M.B. [1151].

The loss of the main shoot of young trees, when followed by the formation of multiple stems, may result in an increase in volume production of timber. The volume of two trees of *Abies pinsapo*, the first of which had ramified at the base into five different trunks, was in the ratio of 100 : 19, while in two trees of *Cedrus libani*, one with a single bole, the other bifurcated, the relation of the volumes was 100 : 166.

21.7. *Wind Resistance*

21.7 : 12.14.4 : 12.25 : 31.8 (94). MILLETT, M. R. O. **Lean and ellipticity of stems of Monterey Pine in the Australian Capital Territory.** *Leafl. Commonw. For. Bur. Austr.* No. 60, 1944. pp. 10 + figs. [1152].

The primary results of thinning and the relation between rainfall and increment in two sample plots of *Pinus radiata* in the Australian Capital Territory have already been described [see *For. Abstr.* 7 (Nos. 219, 449)]. The present leaflet gives measurements of the lean of the stems from the age of 18 to 26 years. Average lean at 18 years was 5·5° and varied by only 0·3° until 25 years when, as the result of very strong winds after heavy rains, it increased to 10·5°, many trees falling as a result of severe leans. There was no significant difference in the leans of trees in the thinned and control plots. The chief results of the leaning of the stem are the formation of compression wood on the underside, possible curvature of the stem axis, and exaggeration of ellipticity. The mean difference in the major and minor axis for

thinned trees increased from 0·45 in. in 1935 to 0·72 in. in 1942, whereas that for the control decreased from 0·43 in. to 0·40 in.

Notes are given on total prevailing winds causing the general lean of 5° which must have developed early in the life of these trees. A diagram is given showing the 'inclinomensor' used for measuring degrees of lean of stems.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.1. *High Forest Forms*

22.14.2 : 24. COOPER, W. E. **In defense of 'selective cutting'.** *J. For.* 43, 1945 (638–9). [State Commission of Forestry, Columbia, South Carolina.] [1153].

The writer discusses and defends the expression 'selective cutting', and proposes a definition of it: 'A lay term signifying the removal of previously selected mature or immature trees in accordance with one or more of the accepted silvicultural systems of intermediate or reproduction cuttings'.

22.14.2 : 12.25 : 21.7. LEBARRON, R. K. **Light cutting in Black Spruce is practicable.** *J. For.* 43, 1945 (486–9). [Lake States Forest Exp. Sta., St. Paul, Minn.] [1154].

From the results of a study carried out by the Lake States Forest Experiment Station, it is concluded that windthrow in Black Spruce (*Picea mariana*) has been overrated as a cause of mortality following partial cutting. Mortality due to windthrow is about three times as great in heavy cuttings as in light cuttings, but it is not the major factor in mortality. Net annual growth for the 5-year period following cutting ranged from 0·88 cord per acre in the stand receiving the lightest cut (25 per cent. of basal area removed) down to 0·04 cord in the stand from which 70 per cent. of the basal area had been removed. Heavier cuttings resulted in negative growth. Cutting not in excess of 30 per cent. of the merchantable volume of trees over 6 in. d.b.h. is desirable and practicable. Cuttings in excess of 30 per cent. lead to increased mortality from all causes and a reduction in net annual increment. Very heavy cuttings practically destroy the productivity of the stands for a long time.

22.14.2 : 33.51 (75.2) : 91.8. HOUGH, A. F. **Silviculture of mine-prop cutting in western Maryland.** *J. For.* 43, 1945 (642–5). [Northeastern Forest Exp. Sta., Philadelphia, Pa.] [1155].

The area studied in this article is typical of a much larger area in the adjoining states of Pennsylvania and Virginia which serve as sources of supply for mine props for the bituminous coal fields. The common practice is to cut props to sizes specified by the collieries, usually from 5 to 15 ft. in length with a minimum top diameter of 3·5 in. inside the bark. The mines prefer round props but accept split props if 8 ft. or less in length. The present study was undertaken to determine whether mine props could be cut in stands too young for sawtimber as a stand improvement measure, without unduly reducing the normal earnings of the cutters or the landlords' returns over the period during which the stand is developing into merchantable sawtimber.

It is concluded that in the long run the greatest benefit all round will come from selectively cutting young second-growth stands on a 10-year cutting cycle. The selection should not be to a diameter limit, but the cut should range over the spread of diameters in order to benefit the stand as well as to give the cutters some of the better paying tree sizes.

22.2. *Coppice Forest*

22.22 : 34.24 : 09.7 (43.1–5). YARHAM, E. R. **The German forests.** *Wood* 10, 1945 (263–6). [1156].

A brief general account of German forests and forestry methods. A method of working Oak coppice, peculiar to the valleys of the southern Black Forest, is described. The hillsides below the conifers are covered with Oak scrub which is cut every 15 years or so, the bark is stripped off for the tanneries, and the smaller branches are burnt on the site. Next year the ground thus enriched is tilled for corn. By the second year after the burning, the tree stumps have sent out shoots too strong to permit of tillage until after the next clearance 15 years later.

22.8. *Silvicultural Description of Forms of Stand*

22.89 (74.7) : 12.25 : 44.3 : 45.3 : 07.6. GUISE, C. H. **The University forest plantations.** *Cornell Plantations* 1, 1945 (43–6). [1157].

The article gives some account of plantations of Pine in the Cornell University Plantations

made at various times since 1912. About half the total area of land reforested was planted to pure stands, mostly of White Pine (*Pinus strobus*). The growth in the White Pine plantations has been rapid and survival good, but a large proportion of the trees has been attacked by the White Pine weevil (*Pissodes strobi*), and badly deformed. The land planted to White Pine was cleared of *Ribes* species, with the result that there has been little damage from *Cronartium ribicola*. In line mixtures of White Pine and Red Pine (*Pinus resinosa*) after 30 years' growth the White Pine is almost completely suppressed. Where Red Pine was planted in pure stands, or mixed with Scots Pine, growth has been rapid and satisfactory in every way.

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

23.1 (485) : 11.47.21 : 23.13 : 11.44. LINDBLAD, O., TIRÉN, L., *et al.* Erfarenheter av naturlig föryngring. Föredrag och diskussion vid Svenska Skogsvårdsföreningens årsmöte 1945. [**Experience with natural regeneration. Lectures and discussion at the annual meeting of the Swedish Forestry Association, 1945.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (105–50). [Sw.] [1158].

The first paper, by O. Lindblad, gives a broad introductory review of the characteristics of natural regeneration, and the conditions and measures under which it is likely to be obtained. Special mention is made of the difficulties occasioned by raw humus, competition from herbaceous vegetation, early summer drought, or damage by grazing, game, and insects.

The second paper, by L. Tirén, stresses the importance of seed supply, conditions for germination, and early seedling growth, with special reference to Norrland, where the problem of securing adequate regeneration is most urgent and where to the difficulties discussed by Lindblad is added the poor seed yield and viability at high latitudes and altitudes. In 1939–42 the Forest Research Institute made a special investigation of natural regeneration on unburnt felling sites in the Spruce forests of Västerbotten, Västernorrland and Jämtland, the results of which have been subjected to detailed statistical analysis. The most important variables proved to be altitude, age of felling site, number of seedbearers and vegetation(-cum-moisture) types. Number of seedlings per unit area showed a striking decrease with increasing altitude, but increased with increasing number of seedbearers (up to 75 per ha. and thereafter a slow decrease), age of felling site, and moisture of vegetation type. Tabulated results for 'fresh' sites, giving number of seedlings with varying altitude and age of site, show that at 350 m. altitude and with the optimum 75 seedbearers per ha. only about 3600 seedlings per ha. are obtained at the end of 30 years. For comparison of natural regeneration and planting, Tirén uses the concept of 'normal regeneration', to which actual regeneration is related by means of a compound reducing factor expressing departure from uniform distribution, varying plant height, and quality. Multiplied by the number of plants per unit area, this factor gives a regeneration index that may be used for direct comparisons. Applying this method, it appears that at 350 m. altitude and with 75 seedbearers per ha. it is impossible even after 30 years to secure regeneration comparable to planting at 2·5 m. The broad conclusion must be that considerable areas of Norrland cannot be naturally regenerated in a reasonable time without auxiliary measures. The latter include burning and the provision of sufficient seedbearers or broadcast sowing, and tractor cultivation. In the author's opinion burning combined with mechanized cultivation offers the best solution.

Contributors to the discussion stressed the rôle of fire in the original forests and the need for controlled burning on heavy humus types. Eneroth emphasized the great importance of moisture and recommended burning for types where, though regeneration might be adequate, the continued presence of raw humus would cause eventual degradation. Wretlind urged the use of veteran seedbearers rather than middle-aged trees.

23.1 : 21 : 12.25–8 (71) : 33.02. LONG, H. D. **Forest regeneration (problems of control).** Canadian Pulp and Paper Association, 3420 University Street, Montreal. *Woodlands Section Index* No. 804 (F–2), 1945. pp. [2]. [1159].

A questionnaire was sent out in 1944 to 70 foresters, on silvicultural requirements of Balsam Fir, White Spruce, Black Spruce, Jack Pine, White Birch and Aspen. A summary of the replies, in so far as they deal with optimum

silvicultural conditions for the 6 species, has been given previously [see *For. Abstr.* 6 (157)]. The present paper gives a summary of replies on conditions that favour or hinder germination of the seed and survival of the seedlings. The data are set out in tabular form and then discussed in some detail. Subjects for further study are recommended.

23.1 : 12.25 (76.5) : 21.64. HALL, W. L. **Is Pine coming or going in South Arkansas?** *J. For.* 43, 1945 (634–7). [1160].

The writer reviews the history of the Pine/hardwood forests in South Arkansas and gives reasons for believing that, contrary to the generally received opinion, Pine is holding its own against hardwoods. Factors in producing this state of affairs were an exceptionally heavy seed crop throughout the region in 1925 following a season of devastating fires, a second good seed year in 1939, the gradual adoption of a system of seed-tree cutting, and, latterly, the heavy cutting of hardwoods owing to the war-time demand for low-grade timber.

23.1 : 12.25 (42.1–8) : 21.0 : 21.3 : 12.11.21. JONES, E. W. **The regeneration of Douglas Fir, *Pseudotsuga taxifolia* Britt., in the New Forest.** *J. Ecol.* 33, 1945 (44–56). [Imperial Forestry Institute, Oxford.] [1161].

The condition and progress of the regeneration of Douglas Fir (*Pseudotsuga taxifolia*) in the New Forest were studied during 1941–43 in Buskett's Lawn Enclosure, which was made in 1864 and planted shortly afterwards. Entry of new seedlings into the crop is erratic, and this appears to be due to erratic seed production. Establishment in the area studied seems to be largely determined by the presence of a carpet of coniferous litter, deciduous litter providing unsuitable conditions. Bare mineral soil is also suitable. In the Pine and the Pine/Oak crop, a carpet of bare litter or litter with moss and little higher vegetation seems to be necessary. When the canopy becomes sufficiently open to permit Douglas Fir establishment, other vascular plants also begin to invade, and in a few years further entry of Douglas Fir becomes impossible. There will thus be a limited period in the development of the crop when a hitherto dense canopy is beginning to open, during which conditions for regeneration are very favourable. In the absence of canopy, open vegetation with much litter and moss also appear to be necessary, and coincidence of a good seed year with the year of felling would apparently be needed to give a good stocking of young Douglas Fir.

In shade tolerance in youth, Douglas Fir exceeds most British species except *Fagus*. In rate of growth, on suitable soils, it is comparable, when young, with Sycamore and Birch, and this high rate is maintained longer, so that at the age of 80 it is usually much taller than any British tree at maturity. These traits, coupled with its ability to regenerate on an organic substratum, appear to fit it for the role of a climax dominant. If, however, its behaviour in the New Forest is characteristic, it would only be able to enter British woodland freely under the rather special conditions provided by the floor of a conifer crop or by the clearance of vegetation by felling, burning, etc.

23.1 : 12.26–8 (77.1–6) : 22.14. ZILLGITT, W. M., and EYRE, F. H. **Perpetuation of Yellow Birch in Lake States forests.** *J. For.* 43, 1945 (658–61). [Lake States Forest Exp. Sta., St. Paul, Minn.] [1162].

In order to determine the effect of kind and degree of cutting in old-growth northern hardwoods on the proportion of Yellow Birch (*Betula lutea*) present in the young growth, a series of reproduction tallies was made in 1944 on 5 areas at the Upper Peninsula Experimental Forest, Dukes, Marquette County, Michigan, cut over in 1927 and 1928. The results of the enquiry show that, following ordinary commercial clear cutting, Yellow Birch maintains itself in the second-growth forest in about the same proportion as in the original stand. Light selection cuttings where an even canopy is maintained are unsuited to Yellow Birch regeneration, since this species cannot compete under shade with more tolerant species, especially Sugar Maple. Moderate selection cuttings with openings resulting from the removal of small groups of poor-risk trees without regard to seed trees, are also unsuccessful in this respect. Yellow Birch may be established successfully in Lake States stands if light partial cutting is practised by employing a group selection method in which openings up to 0·1 acre in size are created within seeding distance of seed trees.

23.13 (66.7) : 24.3. GOLD COAST. **Report on the Forestry Department for the year 1944–45.** Govt. Printing Department, Accra. 1945. pp. 7. [1163].

In the Subri Forest Reserve, which is Tropical Lowland Rain Forest of the *Cynometra/Lophira* association, 10 plots were laid down in the area which had been subject to exploitation for timber, poles, and firewood. The series is: two controls in untouched forest (canopy 0·8–0·9), two under the rather dense canopy (0·6–0·8) left by removal of poles only, and two sets of three plots each in successively lighter canopies (0·3–0·6 and 0·0–0·3) caused by more intense working. Exploitation had occurred 12–15 months before the plots were established. Seedling counts were made on all plots. A tentative conclusion was reached that the optimum regeneration of valuable species is obtained where the upper canopy has been widely opened and at the same time the lower storey and shrub layer almost entirely removed; under such conditions the valuable species regenerate more successfully and in greater variety. This refers only to initial regeneration; establishment and survival under these conditions will be studied in future years (pp. 2–3).

23.2. *Artificial Regeneration*

23.2 (73). TOUMEY, J. W., and KORSTIAN, C. F. **Seeding and planting in the practice of forestry.** John Wiley and Sons, Inc., New York. 3rd ed., 1942. pp. xxii + 520. [1164].

In this edition the same general plan of presentation has been followed as in the second edition (1931). Because of the increasing emphasis now being given to the production of nursery stock for planting on particular sites and the inauguration of greatly enlarged planting programmes, Chapter VII, 'Planting Surveys and Plans', has been enlarged in order to give greater emphasis to this work. Although the main purpose is to evaluate only the more important methods and practices, a number which may find rather limited application in the United States have been included for completeness. Very few cost figures are included for the various nursery and planting operations, but time figures are usually given, so that any desired wage scale can be applied in determining probable costs. After an historical and economic introduction, the first part of the book is devoted to the objects of silviculture and methods of reproduction; the choice of species in natural regeneration; and the principles which determine spacing and the composition of the stand. Part 2 deals with the formation of forests by seeding and planting in the following sections: natural versus artificial regeneration; planting surveys and plans; collection, extraction and storage of forest tree seeds; seed quality and seed testing; protection of seeding and planting sites; establishing forests by direct seeding; selection and development of nursery sites; preparation of nursery seedbeds and seedling culture; transplant culture and distribution of nursery stock; nursery diseases and injuries; forest planting, the material, seasons, spacing methods, planting rules and technique. Each of the subdivisions of the subject matter is followed by a list of references, and an appendix gives the common and technical names of tree species mentioned.

23.2 : 12.26–8 (485) : 24 : 45.1. JUHLIN DANNFELT, M. **Några synpunkter på anläggning och skötsel av lövträdsbestånd.** [**Some points of view on the establishment and care of hardwood stands.**] *Svenska Skogsv-Fören. Tidskr.* 43, 1945 (151–64). [Sw.sw.] [1165].

In spite of the strong demand for hardwood timber, which is imported in considerable quantity in normal times, yields in the hardwood region of southern Sweden have been neither large nor valuable enough to induce forest owners to bear the costs of maintaining or extending the area under hardwoods. The chief reason is the lack of proper tending, which has resulted in low-grade timber for which there has been little demand. Quality timber of Oak, Ash, and Beech can be raised only on the best sites in the region. Young crops must be kept dense, and this greatly adds to the cost of sowings and plantings; the possibilities of natural regeneration have not been adequately investigated. Grazing and deer or elk browsing must be eliminated. Intensive tending operations must be introduced from the beginning and maintained throughout the life of the stand. Pruning and measures against the formation of epicormics are often necessary.

23.2 : 12.26–8 (729.1) : 21. ROIG, J. T. **Las plantaciones de cedro en Cuba: causas de su fracaso.** [**The Cedro plantations of Cuba: causes of their failure.**] *Alm. Minist. Agric. Cuba* 1945 (135–7). *Abstr.* in *Trop. Woods* No. 83, 1945 (26–7). [1166].

In the interior of the Island of Cuba most of the Cedro [*Cedrela* sp.] plantations made in

pure stands in open fields have failed, and the same is true of plantings in impermeable and in very dry and arid soils.

The author considers the following conditions most favourable for the cultivation of Cedro: (1) a fertile terrain, mostly calcareous, and with an alkaline or neutral reaction; (2) an inclined terrain or one with drainage; (3) lateral shade during the first years, which could be given by *Platanus* or similar species; (4) planting in association with other non-dominant, shade-giving trees, and protection against the wind.

23.2 : 12.26–8 (729.7) : 21.2–3 : 23.52. CATER, J. C. **The silviculture of *Cedrela mexicana*.** *Carib. For.* 6, 1944–45 (89–113). [E.Span.f.] [1167].

Cedrela mexicana, which is a valuable species widespread throughout the Caribbean, fails to regenerate naturally to the degree which might be expected having regard to the number of trees and high seed production. Numerous attempts to form pure plantations in various Caribbean countries have failed [cf. *For. Abstr.* 4 (158), 5 (21), 6 (81)]. The writer investigated the occurrence of the species in Trinidad, where it is much more numerous on cultivated land than in natural forest. Most of the trees are found on drainage banks along roads, on artificially drained banks in fields, on ridges and knolls in land subject to shifting cultivation, and around houses. In natural forest the Cedar is almost confined to the upper parts of steep slopes, ridgetops and knolls. From this it is concluded that for proper growth this species requires a well drained site; it is suggested that Cedar should be planted under a light shelterwood with only about 40 trees per acre, these to be sown or planted on specially prepared artificial mounds to ensure adequate drainage of every individual site. Such mounds have been prepared in Trinidad by marking out a square of 5 × 5 or 6 × 6 ft. and removing the litter in a strip 2 ft. wide round the square. The litter is spread within the square and the topsoil from the bared strip is dug out to a depth of 3 in. and spread in the square over the litter and shaped into a slightly convex surface. The mounds are from 12 to 18 in. high. Seeds are sown, or seedlings planted, in the middle and the mounds are mulched. Each mound costs about 14 cents in Trinidad and takes one hour to prepare; the mounds are made at roughly equal distances throughout the plantation, avoiding badly drained areas.

23.2 : 12.26–8 (82). SCHIFANI, A. Breves instrucciones sobre el cultivo del álamo. **[Brief instructions for the cultivation of Poplar.]** *Suelo argentina* 4, 1945 (370–1, 404). [Span.] A.P.B. [1168].

Practical advice is given on soil and moisture requirements of Poplars, preparation of the soil, methods and time of planting, spacing, and pruning. It is most important that the quality and productivity of the planting stock should be kept at a high standard by means of selection.

23.22. Preparatory Work. Auxiliary Measures

23.22.2 : 12.26–8 (54.2). HUQ, M. Z. **Technique of Sal taungya in the Gorakhpur Forest Division (U.P.).** *Indian For.* 71, 1945 (150–3). [Indian Forest Service.] [1169].

An outline of the methods used in the Gorakhpur Division for the raising of *Shorea robusta* in *taungya* plantations. Instead of the 16-inch boat-shaped *nalis* dug in the past, the *nalis* are now dug only about 9 in. deep and 9 in. wide at the top, with sides narrowing down to 5 in. at the bottom. The earth is scattered on both sides of the *nali* for better weathering before it is put back, after a thorough drenching, in the following June.

A new method of sowing Sal seeds has also been introduced. The seed-bed line is raised into a ridge about 6 in. above the ground level to allow for better aeration, to accelerate germination and to discourage the development of side roots. The high ridge also prevents the bed lines from sinking below the ground level when they settle down during the rains. The Sal seeds are sown in one row only, about 2 in. deep and 4 in. apart, along the centre line of the ridge. Sowing of Jamun (*Eugenia jambolana*) with Sal is not recommended.

When the forest sowings are complete the cultivators are allowed to sow approved crops between the lines. In the fourth and fifth years (i.e. when the plants are 3–4 seasons old) crops of Arhar (*Cajanus indica*) take the place of the cultivated crop as a soil cover to protect the Sal plants from frost, prevent the invasion of weeds, and improve the soil.

Experiments have shown that by means of cutting back and burning areas of defective

growth it has been possible to obtain good coppice shoots. Coppice growth on clear-felled areas should be retained instead of being destroyed as hitherto, and further regeneration of Sal should be obtained by *taungya*. It is proposed that the forest crop, including coppice shoots, should be cut back and burnt when it is 5 years old in order to avoid the defects commonly found in direct *taungya*-grown plants. The *taungya*-cum-coppice method results in much less deterioration of forest soil by exposure than does the simple *taungya* method. It has been tried successfully in Lachhmipur Range and is being extended to other areas.

23.22.2 : 12.26–8 (54.2). OSMASTON, B. H. **Sal taungya in Gorakhpur Division, U.P.** *Indian For.* 71, 1945 (282–4). [Eastern Circle, U.P.] [1170].

A comment by the Conservator of forests on a previous article on Sal *taungya* [see preceding abstract], in Gorakhpur Division U.P. A number of plots for comparing results obtained by deep and shallow trenching, dense and sparse sowings, etc., are to be laid out, and it will be some years before a verdict is possible.

23.22.2 (66.4) : 23.13. SIERRA LEONE. **Report on the forest administration of Sierra Leone for the year 1944.** Govt. Printer, Freetown. 1945. pp. 14. [1171].

Taungya is becoming more popular in Sierra Leone and the 1944 tree and rice crops were successful. 1069 acres were completed under IM type of plantation, i.e. widely spaced with natural regeneration encouraged. Planting lines, 66 ft. apart, are opened up where regrowth is not too heavy (p. 6).

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.15 : 12.26–8. NYASALAND. **Report of the Department of Agriculture for the year 1944. Part I. Agriculture in Nyasaland. Part II. Experimental work.** Govt. Printer, Zomba. [1945?]. pp. 8 + 12. [1172].

Tung (*Aleurites* sp.) seed stratified for 4 months between layers of sand or sawdust was compared with seed stored in a normal manner for the same period. Percentages of germination were as follows:—

Seed stored in normal manner	49 per cent.
Seed stratified in sand	79·25 per cent.
Seed stratified in sawdust	78·25 per cent.

(II, p. 9).

23.23.15 : 12.26–8. GRIFFITH, A. L. **Storage of seed of *Prosopis* species.** *Indian For.* 71, 1945 (251–2). [Forest Research Institute, Dehra Dun.] [1173].

Following the suggestion to use the chemicals naphthalene and paradichlorbenzene in dealing with insect pests of the seeds of *Prosopis* spp., tests were carried out to determine their effect on seed germination. Results show that normal doses of the chemicals (1 gm. per litre) have no adverse effect, and that even a very heavy overdose has little or no effect, on the germinative capacity of seeds of *P. juliflora* or *P. glandulosa*.

23.24. Formation of Stands by Planting

23.24 : 12.25 : 23.24.1 (485). HEDEMANN-GADE, E. Undersökningar angående barrträdsplantering vid olika tidpunkter samt med skilda metoder och plantslag. [**Research on the planting of conifers at different times and with different methods and types of stock.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (1–48). [Sw.sw.g.] [1174].

From this investigation of Pine and Spruce plantings on difficult sites in the Stockholm Archipelago it appears that the chief adverse factors are fluctuations in seasonal rainfall and competition from ground vegetation. The local soils are mostly derived from moraine-gravel drifts and glacial clays over leptite, which is frequently exposed as outcrops; they are best where calcareous ground water percolates through gravel over clay. Though the results can apply in full only to analogous soils in a similar climate, e.g. to considerable areas on the mainland opposite to the Archipelago, the following points are considered to be worth more general attention:—

(i) On grassy sites the soil must be bared in patches about 40 cm. square, not only for notching but also for pit planting. This treatment improved results by 100–200 per cent.

(ii) In general, 2–2 transplants spaced 1·75–2 m., with open pit planting, gave best results for Spruce; but on stony or grass-bound sites 2–1 transplants, notch-planted, also gave

good results, and where frost-lift was prevalent, notch-planting was the better method. After 20 years, results from transplants were 30–40 per cent. better for Pine, and often over 100 per cent. better for Spruce, than those from seedling plants.

(iii) Spruce can be planted as long as the soil is not frozen hard. Where regular early-summer drought occurs, planting should not be done in months with less than 40 mm. normal precipitation unless that of the preceding month has been exceptionally high (over 60 mm.).

(iv) On grass sites, Pine is best planted as transplant stock which may be notch-planted provided that the notch is large and the soil cover removed. Pine should be planted only in early spring or after 15th September.

(v) Where early-summer drought is pronounced (monthly precipitation less than 40 mm.), the planting of transplants on cultivated patches is the only method that will give reliable results.

(vi) On moister sites protected from grazing no planting is necessary even with high site quality and heavy grass cover, since soil cultivation alone will assure the establishment of closed Birch stands if there are seedbearers within 100–200 m.

23.26. Plant Rearing. Nursery Practice

23.26 (410) : 23.23.15 : 23.26.3. WARD, J. D. V. **In a forest nursery.** *Wood* 10, 1945 (211–3). [1175].

A short, popular article on British nursery practice, including collection and treatment of seed, preparation of seedbeds, and transplanting.

23.26.3 : 23.27. MILLER, Z. **Transplanting large trees.** *Hassadeh* 25, 1945 (87–9). [Heb.] L.S. [1176].

23.27. Arboriculture

23.27. MALMBORG, G. E. **More unusual trees and shrubs.** *Amer. Nurserym.* 82 (6), 1945 (9–12). [1177].

Among the trees listed for ornamental planting are species and varieties of *Abies*, *Chamaecyparis*, *Cunninghamia*, *Cupressus*, *Cryptomeria*, *Libocedrus*, *Pinus*, *Tsuga*, and *Zizyphus*. [Cf. *For. Abstr.* 6 (90).]

23.27 : 41. THOMAS, F. C. **Should cavities be filled?** *Trees, Sta. Monica* 6 (3), 1945 (7, 14). [Thomas Tree Experts, Greensboro', N.C.] [1178].

The writer favours the filling in of cavities in ornamental trees rather than the method of leaving them open until the growth of callus has naturally sealed them. The time taken in the latter process is so long that decay is almost certain to spread before the bark has grown over the wound.

23.3. *Afforestation*

23.3 (41.5) : 21.0 : 12.11.3 : 22.83. STEWART, D. **Afforestation in Northern Ireland.** *Irish For.* 2, 1945 (54–6). [1179].

Northern Ireland, with less than 2 per cent. of woodland, is greatly in need of large-scale afforestation. Before the war, the woodland area, apart from small areas of less than 3 acres, was about 60,000 acres, of which at least one-quarter was unproductive. It is estimated that at least one-fifth of the productive areas has been felled since 1939. The area of woods and plantations now owned by the Ministry of Agriculture is about 20,000 acres; the total area of land acquired by purchase and lease is now over 34,000 acres, of which something like 6,000 acres are unplantable owing to various causes. Where suitable land is acquired hardwoods are planted, but conifers form the bulk of the plantations. A larger area of Sitka Spruce is planted than of any other species, and Norway and Sitka Spruce together occupy more than half of the plantations. Sitka Spruce is used on all the poor peaty soils and exposed elevated areas. Douglas Fir gives good results on moderately light, rather dry, soil. European and Japanese Larches are planted extensively. All seed supplies of European Larch are either collected at home or procured from the North of Scotland, as it has been found that plants grown from Continental seed are much inferior to those produced from seed grown in the British Isles. Japanese Larch grows well on a variety of soils. Very fertile soils are avoided, as they tend to produce a rather coarse, twisted type of tree. Scots Pine is used only on sites unsuitable for other species, and, where suitable, 12½–25 per cent. of *Abies nobilis* is planted in mixture with the Pine. Scots Pine does well in the Mourne area, but over the rest of the Six Counties early development is retarded by defoliation, which takes place each winter and spring and appears to be due to climatic conditions. Once canopy is

formed, defoliation becomes less troublesome and usually disappears altogether. *Pinus murrayana* is used to a limited extent on the poorest sites and as a nurse to Sitka Spruce on the poorer heather-covered peats. *Abies grandis* is used to a limited extent, but as it requires a fertile soil and the timber produced, though plentiful, is of poor quality, it is not thought advisable to plant this species extensively. Hemlock Spruce is used for underplanting thin stands of hardwood and for filling up gaps in natural regeneration. It grows very rapidly under these conditions and is regarded as a tree well worth cultivating. Together with *Thuja* it is used in admixture with European Larch, 12½ per cent. of one or other species being mixed with the Larch.

23.3 (485) : 06.1. PETRÜS. En skogsodlingsförening i Bohuslän. [**An afforestation society in Bohus County.**] *Skogen* 32, 1945 (275–6). [Sw.] [1180].

A brief historical note on the Kville afforestation society, formed in 1890 for the encouragement of heathland afforestation. Since its inception over 8 million plants and 25,000 kg. of seed have been used to afforest areas totalling 2,100 ha., mostly with Pine and Spruce. The local council contributes 200 kr. per annum and each member subscribes 50 öre; the work is carried out with the aid of grants from the county forestry board and other local bodies, and members of the society have preference.

23.3 (67.5) : 21.0. ROSSIGNOL, C. Le reboisement dans la zone montagneuse du Congo Oriental. [**Reafforestation in the mountain zone of the Eastern Congo.**] *Bull. agric. Congo belge* 33, 1942 (289–331, 459–85 + plates). [F.flem.] [1181].

The deforestation of the mountain slopes on the eastern border of the Belgian Congo has for some time caused concern, and a good deal of reafforestation has been carried out, mainly with Eucalypts, Cypress (*Cupressus* spp.), Black Wattle (*Acacia decurrens* var. *mollissima*), Filas (*Casuarina* sp.) and Silver Oak (*Grevillea robusta*), mostly in pure stands. The writer describes the process of reafforestation in Unya-Bongo. He first gives an account of the region, its hydrology, climate, soils, natural vegetation and then detailed notes on the plantation and silvicultural characters of a number of species. The often-planted Eucalypts do not enrich the ground but consume a great deal of water, and are not to be recommended. The Cypress is much more satisfactory, so long as it is planted in good conditions. Black Wattle has the great advantage of enriching the soil and providing tanbark. Silver Oak, which was much planted by settlers as a wind-break, provides good timber. The writer describes the various methods of planting these and other species. He is of the opinion that, apart from species particularly suited to special conditions, mixed plantings should be the rule. In this connexion, he gives the results of recent experiments, and discusses possible applications arising from them. The use of indigenous timber species is recommended, such as Bamboos, *Maesopsis*, *Macaranga*, *Dombeya*, *Spathodea*, *Carapa*, *Markhamia*, *Podocarpus*, *Hagenia* etc. Experiment is necessary to decide the best mixtures. *From author's summary.*

23.3 : 23.2 (729.2). JAMAICA. **Annual report: Forest Department for year ended March 31st, 1945.** Forest Department [Kingston], Jamaica. 1945. pp. 9. [1182].

Much of the accessible forest area has been over-exploited and deforested to an extent which will necessitate artificial reafforestation planned at 2,260 acres a year. The main planting sites lie within a rainfall range of 60–100 in. and an altitude range of 1,000–4,000 ft. Sites are universally degraded, often highly acidic, and almost devoid of organic matter content. On the worst sites, direct seeding of Santa Maria (*Calophyllum antillanum*) shows promise for a wide range of altitudes, but this species is intolerant of very dry conditions. For such conditions, stump-planting of Yokewood (*Macrocatalpa longissima*) appears to be successful. Under more mesophytic conditions, Blue Mahoe (*Hibiscus elatus*) is outstanding, while on the limestone, Fiddlewood (*Petitia domingensis*) grows well even with a high proportion of surface rock. Mahoe has suffered sporadically from 'scale' but all outbreaks have been controlled. There appears to be a correlation between scale infestation and density of planting: in the more open stands (spacings of 8 ft. and over) infestation has been less (pp. 5–6).

23.3 (74.8) : 11.62.11 : 96.5. BEARER, V. M. **Restoration of strip-mined lands.** *For. Leaves* 35 (2), 1945 (7–8). [1183].

During the past few years, many forest-tree

plantings have been made in Pennsylvania on spoil mounds resulting from open-cast mining, without any soil preparation whatever. Some of them are partially successful with a stand of from 50 to 75 per cent. of the planting stock living three or four years after planting. With few exceptions, all areas suffer seriously from sliding and erosion and there is small chance of success with planting carried out before the earth is stabilized.

At least one coal company in Western Pennsylvania has made a good start in reclamation. With the use of bulldozers, four or five different areas have been levelled to conform closely with the original contours. On a few of the completed sites, farm crops are now being grown successfully and doing as well as, and in some cases better than, similar crops on nearby farms. It has been observed that forest planting stock on untreated spoil banks often grows better than on the adjoining fields.

It is generally agreed that if the areas are to be returned to productivity the agency mining the coal should be charged with this obligation. Sites which are flat or gently sloping will doubtless prove good farm land if sufficient money is spent to level them into plains suitable for farm machinery. Areas where the slopes are steep and rocky should be artificially reforested. Too little restoration has yet been done to permit of estimates of the cost of such work.

23.3 (77.3) : 91.3. HOLMES, L. A. **Reclaiming stripped lands in Illinois.** *Sci. Mon., Wash.* 59, 1944 (414–20). L.S. [1184].

Up to 1941 some 23,981 acres had been strip-mined for coal in Illinois. A brief account is given of the use being made of the resulting spoil mounds for forest, pasture, recreational areas and games preserves. By 1943 a total of 8,466 acres had been afforested, twenty species of trees being used for this purpose. A high percentage of survival was obtained for all species except Osage Orange (*Maclura pomifera*). Black Locust and Shortleaf Pine gave survival percentages of 92 and 77 respectively. In many cases the use of spoil mounds for these purposes will give yearly profits as great as those produced by the land before mining.

23.4. *Formation of Forest by Natural Succession*

23.4 (66.7) : 12.19.4. GOLD COAST. **Report on the Forestry Department for the year 1944–45.** Govt. Printing Department, Accra. 1945. pp. 7. [1185].

In the Eastern Province a study was made of the natural regeneration of tree species on an area formerly a cocoa farm, which had been severely attacked by 'swollen shoot' and then wholly cleared by the Agricultural Department 3–4 years ago. The following pioneer tree species were found to have established themselves: numerous species of *Albizzia* and *Sterculia*, *Triplochiton scleroxylon*, *Entandrophragma* spp., *Chlorophora excelsa*, *Terminalia ivorensis* and *Khaya* spp. (p. 3).

23.4 (67.5) : 11.47.6 : 23.3 : 21.0 : 43.1 : 97.1. HUMBLET, P. Le regénération par le reboisement des terres épuisées du Bas-Congo. [**Regeneration through afforestation of degraded soils in the Lower Congo.**] *Bull. agric. Congo belge* 35, 1944 (137–65). [F.] [1186].

The writer was instructed in 1937 to study the technique of a programme of reafforestation in the territories of Cataractes, Inkisi, and Manianga. After 1940 the exigencies of war led to the abandonment of the project, but the experience gained will enable a future programme of reafforestation to be carried out with the maximum chance of success. The technique which was evolved rests essentially on the principle that very little primary savanna survives and that the great majority of existing savannas, and all of those on arable (not stony or lateritic) soils, are due to bush fires following native cultivation. Conversely, the only obstacle to natural reforestation of savanna is bush fire. Experience confirms this theory. Areas of savanna, some of a very poor type, were protected from fire for a few years, and after 4 or 5 years, with no other treatment, were already rather forest than savanna, while similar areas beyond the fire-break were still savanna. The first effect of fire protection is the thickening and heightening of the herbaceous cover. Next the various shrubs which compose the bush (spp. of *Hymenocardia*, *Annona*, *Sarcocephalus*, *Albizzia*, etc.) develop actively and attain heights of 10–15 metres. Other species introduced by various means of dissemination, notably birds, then begin to appear (*Pentaclethra macrophylla*, *P. eetveldiana*, *Vernonia conferta*, *Ficus*, various species of Leguminosae).

The problem of reforestation and regeneration of savannas therefore reduces itself to

protecting blocks of savanna by an effective system of fire-breaks. The only type of fire-break which guarantees protection is a forest screen, and reafforestation, properly so-called, consists in the creation of such a screen. Supposing that an area of 40 ha. is to be reafforested, instead of disposing the plantation in a single block of, say 500 × 800 m., the method employed would be to establish a strip not more than 100 m. wide and not less than 4,000 m. long, as a border round a block of savanna which it would entirely surround and so protect from bush fires. This area would then be left to lie fallow until natural reforestation had regenerated its soil. The strip of woodland forms a permanent fire-break and, incidentally, a source of fuel and timber, which are very scarce in savanna country. The fallow area, on the other hand, will be cultivated on a proper rotation, under the shelter of the fire-break, as soon as its fertility is restored. It is necessary to choose the areas to be treated so as to obtain the maximum ratio of protection (i.e. ratio of area protected to area reafforested), by using natural fire-breaks (forest fringes, rivers, gallery forests) and by enclosing the largest practicable blocks: a 10,000 m. strip of woodland will protect only 560 ha., while 100,000 m. will protect 59,600 ha.

Some account is given of the difficulties encountered in getting native labour for making plantations, and the methods adopted to overcome them, and the writer then proceeds to discuss the choice of species. The function of a permanent fire-break demands that at least one of the species planted should coppice freely and retain its foliage in the dry season; this species will be managed as coppice and should, therefore, be a good fuel wood. The species which are to be managed as forest trees should be good timber species. In the experiments in the lower Congo, the species used for coppicing were *Cassia siamea*, alone or associated with *Pentaclethra macrophylla*, and for forest trees *Eucalyptus citriodora*, *E. robusta*. All of these proved excellent for the purpose. *Chlorophora excelsa*, though slow-growing, was also used as a forest tree species, because of the usefulness of its timber. The *Cassia*, *Eucalyptus* and *Pentaclethra* may be mixed in equal proportions, either in alternate rows or in groups of 2 or 3 rows. *Chlorophora* should be introduced into such mixtures at fairly wide intervals, for instance as each 5th plant in every 4th row. Details are given of methods of planting, nursery practice, collection and treatment of seed, protection of plantations from fire, choice of sites for planting, etc. [Cf. *For. Abstr.* 7 (No. 1499).]

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

24.2. Assmann. Gedanken zur wissenschaftlichen Begründung der Durchforstungstechnik. [**Notes on the scientific basis of thinning technique.**] *Allg. Forst- u. Jagdztg.* 120, 1944 (69–76). [G.] [1187].

The writer divides his subject into two parts: (1) the influence of thinning on yield, and (2) the influence of thinning on form and quality of timber. The first part is illustrated by the results of experimental thinnings carried out over varying periods on sample plots of Beech and Spruce. After explaining the method of analysing the results of these experiments, he concludes that only thinnings of the lower storey which remove not less than 11 per cent. of Beech and 17 per cent. of Spruce make a significant difference in total yield. He stresses the need for further investigation of the relation between amount of foliage and increment.

24.2 : 12.25 (77.4 : 77.5 : 77.6) : 56.2 : 33.02. Eyre, F. H., and Zehngraff, P. J. **Supplying Lake States needs for Pine pulpwood through thinning.** Canadian Pulp and Paper Association, 3420 University Street, Montreal. *Woodlands Section Index* No. 803 (A–1), 1945. pp. [3]. [Lake States Forest Exp. Sta., St. Paul, Minn.] [1188].

In 1940 a commercial thinning was made on 3 plots of Jack Pine (*Pinus banksiana*) at the Chippewa National Forest and a 4th control plot was left unthinned. About 4 cords of merchantable pulpwood were removed from each of the 3 thinned plots, much of the cut being salvage of uprooted and broken trees. After the plots were measured in 1944, another thinning to remove the less promising trees that had reached merchantable size took out from 4 to 4½ cords per acre.

During the years 1939–44, the net annual growth in the thinned plots was 1·1 to 1·5 cords per acre. The earnings of the men engaged in

the operations indicate the practicability of such operations in present economic conditions. It is suggested that by frequent thinnings and other salvage it may be possible to increase the yield of pulpwood in well stocked Jack Pine stands by the time they reach an age of 50 years by as much as 25 cords per acre on good sites and 20 cords on average sites.

24.25 : 12.25 : 22.28.1. SCHANTZ-HANSEN, T. **Some results of thinning fifteen-year-old Red Pine.** *J. For.* 43, 1945 (673–4). [Cloquet Forest Exp. Sta., Cloquet, Minn.] [1189].

In 1927 four $\frac{1}{10}$-acre thinning plots and a check plot were established in a dense stand of 15-year-old Red Pine (*Pinus resinosa*) at the Cloquet Forest Experiment Station. Analyses of their establishment and of 5-year and 10-year measurements have been published, but for convenience all the data taken since the establishment of the plots are included in this report.

Re-measurements in 1932 and 1937 showed some advantage in diameter growth for the 7-by-7 spacing, but in 1942 the 9-by-9 spacing had taken the lead. The current height growth of the unthinned plot indicates that over-stocking has slowed up its development. There was no loss of trees on the thinned plots between 1937 and 1942. The loss of 1,160 trees on the control plot during this period indicates the severe struggle for survival on that plot.

24.21 : 12.25. AVERELL, J. L. **Rules of thumb for thinning Loblolly Pine.** With comment by H. H. Chapman. *J. For.* 43, 1945 (649–51). [U.S. Forest Service, Atlanta, Ga.] [1190].

The writer analyses the results in number of trees per acre of the various current rules of thumb for thinning *Pinus taeda* and presents his findings in the following table.

Rule of thumb	*With 6 in. d.b.h.*	*Recommended spacing in ft.*	*No. of trees per acre*
2 × d.b.h.	2×6	12×12	303
6 + d.b.h.	6+6	12×12	303
4 + d.b.h.	4+6	10×10	436
1·5 × d.b.h.	1½×6	9×9	538
2 + d.b.h.	2+6	8×8	681

He also gives graphs, one comparing a number of rules of thumb for thinning, the other showing number of trees per acre, their spacing, approximate basal area, and need for thinning.

24.3. *Opening of the Canopy. Release and Improvement Fellings*

24.3 (71) : 12.25. ROBERTSON, W. M. **Succession cutting in Pine.** *Silvic. Res. Note Dom. For. Serv.* No. 74, 1945. pp. 8 + tbls. [1191].

The results are given of a sample-plot study of the effect of removing a 70-year-old overstorey of Jack Pine (*Pinus banksiana*) to release the succession stand of young White and Red Pine (*P. strobus* and *P. resinosa*), with reference to changes in crown-class distribution, density, and growth in diameter, height and volume. Diameter growth was greatly stimulated, height growth slightly retarded. Volume growth was increased from 1·1 per cent. to 4·5 per cent. Great as is the value of treatment in improving volume growth, the improvement in quality increment, by transferring growth from mature Jack Pine to immature White and Red Pine, is much more important. The project clearly indicates that succession cuttings should be made in stands of this nature.

24.4. *Shelterbelts. Windbreaks*

24.4 (76.4 : 76.6). STOECKELER, J. H. **Narrow shelterbelts for the Southern Great Plains.** *Soil Conserv.* 11, 1945 (16–20). [Lake States Forest Exp. Sta., St. Paul, Minn.] [1192].

In the summer of 1942, the writer examined a number of shelterbelts in Oklahoma and Texas planted between 1935 and 1942 in order to determine the relative effectiveness of one-, two-, and three-row belts and to test several intensities of protection by varying the species and spacing between the belts. The outstanding features of the 9-year-old shelterbelts are their remarkable growth rate and their effectiveness in stabilizing the soil and reducing wind erosion. Most of them are 30 to 48 ft. high and form a dense and effective wind barrier. Reduction of wind erosion began at 5 years old, and at 20 to 25 ft. high. Cottonwood (*Populus* sp.) is one species appearing in every

belt. The species selected to flank the Cottonwood are of slower growth and were chosen to fill the gaps which would appear in the lower part of the Cottonwood, which sheds its lower limbs 8 to 15 years after planting. Among the best two-row combinations are Cottonwood and Mulberry, and Cottonwood and Chinese Elm (*Ulmus pumila*). Effective three-row combinations are Mulberry, Chinese Elm and Russian Olive (*Elaeagnus angustifolia*) in one belt and Mulberry, Chinese Elm and Green Ash (*Fraxinus pennsylvanica* var. *lanceolata*) in a second belt. A single-row belt with Cottonwood and Mulberry planted alternately makes a very effective combination because of the interlacing of the limbs into a two-storeyed pattern. Another effective belt is a single row of Mulberries, which was 20 ft. high at 9 years, making a dense screen. Such plantings made at intervals of 300 to 400 ft. can be made to yield a continuous crop of fence posts by cutting out some of the larger stems. The cut stems promptly spring up and make the tree even more bushy and leafy.

It is concluded that, in those parts of western Oklahoma and northern Texas where rainfall is about 24 to 26 in. per annum, results of experimental planting and data on crop response tend to favour planting of rather narrow shelterbelts of one to four rows. An interval between east-west belts of $\frac{1}{8}$ mile and between north-south belts of $\frac{1}{4}$ mile gives adequate protection to cropland if the tall-growing trees are of species which will attain an ultimate height of 60 to 80 ft. Where they attain heights of only 20 to 30 ft. the interval between east-west belts should be about $\frac{1}{16}$ mile. The alternation in a single-row belt of two species of widely different growth habit and form proved successful and introduces a new principle in shelterbelt planting.

3. FOREST UTILIZATION. FOREST TECHNOLOGY.

3 : 01.6. **List of publications on logging, manufacture and utilization of timber, lumber and other wood products.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*790, 1945, pp. 29. P.R. [1193].

A list of publications giving the results of research by the Forest Products Laboratory, Madison on methods and practices in the lumber-producing and wood-consuming industries; standard lumber grades, sizes and nomenclature, production and use of small-dimension stock; specifications for small wooden products; utilization of little-used species and commercial woods; and low-grade and wood-waste surveys. Other American Government and commercial publications on these subjects are included.

3 : 01.6. **Partial list of Government publications of interest to architects, builders, engineers and retail lumbermen.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1081, 1945. pp. 18. P.R. [1194].

A list of American publications on fungous defects in forest products; growth, structure and identification of wood; manufacture and grading of lumber; mechanical properties and structural uses of wood and wood products; seasoning, finishing and preservation of wood. Other publications issued by the U.S. Forest Products Laboratory are also listed.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31 : 33. JAY, B. A. **Timber: an outline of the structure, properties and utilization of timber.** Timber Development Association Ltd., 75 Cannon St., London, E.C.4. 1945. pp. 38. [1195].

This illustrated booklet, which was first published in 1937, has been brought up to date in the light of recent developments; for example, the section on the chemical composition of wood has been entirely re-written. There are sections on composition of wood, structure of wood, seasoning, mechanical properties, conversion and manufacture, durability, diseases, preservation, resistance to fire, and some aspects of utilization (wood gas, wood sugar and insulation). There is a bibliography with 50 references.

31.0. *General Information on Woods*

31.0 (73) : 33. MOLDENKE, H. N. **Strategic woods.** *Nat. Hist., N.Y.* 53, 1944 (54–9). L.S. [1196].

The author emphasizes the importance of wood in the manufacture of navy, army, and air-force equipment and briefly discusses some

of the more important strategic woods, in particular Balsa (*Ochroma lagopus*), Mahogany (*Swietenia macrophylla*), and Cork Oak (*Quercus suber*). Large quantities of Balsa are now produced from stands on abandoned banana plantations and other clearings in Guatemala, and commercial plantations of this species have been started in Ecuador, Costa Rica, Nicaragua, and Colombia. More than 60,000 vigorous young Cork Oaks have been established in America since 1940, and an additional 150,000 seedlings are ready for planting.

31.0 : 12.25–8 (72). JOERNS, A. **The commercial timbers of Mexico.** Arnold Joerns, 333 North Michigan Avenue, Chicago 1, Illinois. 1944. pp. [i] + 21. L.S. [1197].

Brief notes on the physical properties and uses of the woods, and in some cases dry weight per cu. ft. and tree dimensions, are given under the native name for each species as used on the Isthmus of Tehuantepec and in the Mexican lumber trade. Species include various tropical woods, as well as Pines, Oaks, Ash and Walnut found in commercial quantities in Mexico.

31.0 (95) : 31.1–2 : 33 : 12.26–8. DADSWELL, H. E. **Timbers of the New Guinea region.** *Trop. Woods* No. 83, 1945 (1–14). [Division of Forest Products, Council for Scientific and Industrial Research, Australia.] [1198].

Not very much was known, before the war, of the timbers and timber resources of New Guinea. The Division of Forest Products, C.S.I.R., Australia was asked to supply information, and developed a simple card-sorting identification key [cf. *For. Abstr.* 4 (32)] for New Guinea timbers. The key is described and lists are given of the principal species, arranged (*a*) according to utility, (*b*) according to anatomical features. Among the commoner species are Laup, Lup, or New Guinea Walnut (*Dracontomelum* sp.), Erima (*Octomeles sumatrana*), Amberoi (*Pterocymbium* sp.), Taun (*Pometia pinnata*), Kamerere (*Eucalyptus deglupta*), Hoop Pine (*Araucaria cunninghamii*), Klinki Pine (*Araucaria klinkii*), Kwila (*Afzelia bijuga*), Kaeda (*Planchonia timorensis*), New Guinea Teak (*Vitex cofassus*), New Guinea Rosewood (*Pterocarpus indicus*), the various Mangroves (*Rhizophora* spp. and *Bruguiera* spp.) and Cedar (*Cedrela toona* var. *australis*). It is emphasized that in the rain forest there is a very great number of different timber species and, because of the height of the trees, the density of the forest, and the mixture of foliage in the canopy, it is practically impossible to identify them all from the ground. In the writer's opinion there is sufficient timber in New Guinea to support a fair-sized timber industry, provided that efforts are made to cut and market a number of species instead of trying to take out only 2 or 3 species: selective logging is practically impossible. The question of access to the forest areas is very important and only coastal areas could be exploited at first. All timber species in such areas and in the foothills are hardwoods. Softwoods, notably Hoop Pine and Klinki Pine, are confined to elevations above 3,000 ft. They are reported to be of excellent quality and size but are, for the present, inaccessible.

The occurrence of tension wood is noted in species of the rain forest, where most of the trees appeared to have long, straight, clear stems, in which tension wood would not be suspected. Bad tension wood was found in the following genera: *Canarium*, *Endospermum*, *Cinnamomum*, *Cryptocarya*, *Litsea*, *Albizzia*, *Artocarpus*. Logs from these species gave considerable trouble in sawing, the saw becoming clogged with long masses of fibre very similar to wood wool. Tension wood was also observed in the buttresses of many other species and in the wood of the stem just above the main buttresses. Its development in the main stem is possibly related to the efforts of the tree to obtain sufficient light in the dense rain-forest jungle. Many trees of the rain forest exude a milky fluid if the bark is damaged; these include species of the Moraceae, Sapotaceae, Euphorbiaceae, Anacardiaceae, Apocynaceae, and Meliaceae. The exudation from some species, particularly those of Anacardiaceae, causes dermatitis.

31.0 : 12.26–8 (67.5). STANER, P. Les acajous du Congo belge. **[The Mahoganies of the Belgian Congo.]** *Bull. agric. Congo belge* 34, 1943 (163–245 + plates). [F.flem.] [1199].

The first African Mahoganies appeared in European markets about 1890 and have steadily increased in popularity. These Mahoganies belong to the genera *Khaya* and *Entandrophragma* and are very similar to the American genus *Swietenia* (the original Mahogany). The introduction of substitutes has continued to the present time on such a scale that their identification has become more and more complicated, and it is therefore considered

desirable to fix the limits of those species which may properly be termed 'Mahogany', with or without a qualification indicating provenance. The situation is still further complicated at the present time, since many wood technicians admit to the title of 'Mahogany' the wood of other genera not belonging to the Meliaceae, notably certain Dipterocarps. The present study, which describes the true and false Mahoganies of the Congo, is confined to the Meliaceae. Analytical keys for the identification of the genera *Carapa, Melia, Trichilia, Ekebergia, Guarea, Leplaea, Turraeanthus, Khaya, Entandrophragma, Lovoa,* according to (1) external morphological characters, (2) wood structure, are followed by detailed accounts of the various species. The information given for each species includes scientific and vernacular names; general description; habitat; appearance, structure and uses of wood.

31.0 : 12.26–8 : 33.8 (67.5). FRISON, E. Notes sur la valeur économique des bois du *Corynanthe paniculata* Welw. et du *Pausinystalia bequaerti* De Wild. **[Notes on the economic value of the woods of *Corynanthe paniculata* Welw. and *Pausinystalia bequaerti* De Wild.]** *Bull. agric. Congo belge* 34, 1943 (537–9 + plates). [F.] [1200].

The true Box (*Buxus sempervirens*) is becoming increasingly scarce, and various substitute 'boxwoods' are in use. The most satisfactory of these is the Zapatero or West Indian Boxwood (*Casearia praecox*), derived principally from Venezuela. The writer believes that two indigenous species of the Belgian Congo, *Corynanthe paniculata* and *Pausinystalia bequaerti* (syn. *Corynanthe macroceras*) would serve as substitutes for Zapotero for many of its uses such as the manufacture of articles of turnery, tool handles, measuring rules, brush backs, musical instruments, combs, etc.; textile shuttles and bobbins; sculpture. Microphotographs of the two wood species are provided.

31.0 : 12.26–8. **Black Cabbage-bark** (*Lonchocarpus castilloi*). *Suppl.* to *Wood* 10, 1945 (273–4). [1201].

An account of Black Cabbage Bark (*Lonchocarpus castilloi*), known also in British Honduras as Bitterwood and Dogwood. It is fairly common in the high swamp forest of British Honduras. The wood is hard and heavy, weighing from 56 to 60 lb. per cu. ft. when dry. If dried slowly it seasons without excessive distortion or shrinkage. Strength properties are good and in spite of its hardness the wood is not difficult to work. It appears to be naturally resistant to decay. It should find a limited market for wharf decking, bridging, machine bedding and similar uses where its great strength and durability can be utilized to advantage.

31.0 : 12.26–8. **Boarwood** (*Symphonia globulifera*). *Suppl.* to *Wood* 10, 1945 (243–4). [1202].

Symphonia globulifera, the Boarwood or Hog Gum of the West Indies, has a wide distribution in Central America and the northern part of South America, the British West Indies and Trinidad; it is also found in tropical West Africa. All other species of the genus are endemic in Madagascar. It is frequently 60 to 100 ft. in height and at maturity varies in quarter-girth measurement at breast height from 14 to 30 in. The timber has a distinct, almost white sapwood, contrasting with the rather variable heartwood. The wood is hard and moderately heavy, its air-dry weight varying from 42 to 50 lb. per cu. ft. In strength it is about the same as Oak, but more fissile. In the West Indies and Central America it is employed in building and for carpentry, cooperage, box boards and railway sleepers. Its use in Europe has been confined to the production of veneer and plywood on a small scale.

31.0 : 12.26–8. BRUSH, W. D. **Foreign woods: Balsa** (*Ochroma lagopus* **Sw.**). Forest Service, U.S. Department of Agriculture, Washington, D.C. 1945. pp. 3 + map. P.R. [1203].

An account is given of the nomenclature and distribution of the Balsa tree (*Ochroma lagopus*), together with a map showing the general area in which it occurs in commercial quantities. It is usually found at elevations from sea level to 3,200 ft., preferring bottomland soil along streams. Growth is extremely rapid, a height of 70 ft. and diameter of 1½ to 2 ft. being attained in 7 years. After 8 years of age the trees sometimes develop a light pink heartwood, and at 12–15 years the rate of growth declines and wood grown thereafter is generally comparatively hard and heavy. The lightest wood is obtained from fast-growing trees between the ages of 4 and 6 years, growing in clearings in the forest or abandoned fields along watercourses. An acre of plantation Balsa in Costa Rica may

yield as much as 5,000 bd. ft., though the average yield may not exceed 2,500 bd. ft. After felling, the tree is cut into logs 16 ft. long and a good tree often yields two clear logs, but the branched part of the tree is valueless.

Balsa wood varies considerably in weight; the specific gravity varies from 0·05 to 0·41 with a usual range of 0·12 to 0·20. Second-growth Balsa in an air-dry condition has been found to vary in weight within the same stem from 7½ lb. per cu. ft. at the centre to 21½ lb. per cu. ft. at the circumference of the log. In the trade the usual range is from 8 to 14 lb. per cu. ft. The strength of Balsa varies directly with its density or dry weight. The modulus of rupture at 12 per cent. moisture content varies from 1,100 lb. per sq. in. for wood weighing 5½ lb. per cu. ft. to 4,300 lb. per sq. in. for wood weighing 17 lb. per cu. ft. The maximum crushing strength parallel to the grain at 12 per cent. moisture content varies from 500 to 2,800 lb. per sq. in. for the same range in weight. At the present time Balsa is used largely for life-saving equipment and as a core material in the 'sandwich' construction for aeroplanes. It is also used to line refrigerator trucks and for food containers.

Other light-weight woods which are possible substitutes for Balsa are named and described. The most important of them is the Silk-cotton (*Ceiba pentandra*); others are *Cavanillesia platanifolia*, *Bombax* and *Chorisia* spp., *Pterocarpus officinalis*, *Annona glabra*, *A. reticulata*, *Leitneria floridana*, *Alstonia* spp., *Aeschynomene* spp., *Herminiera elaphroxylon*, *Nyssa aquatica*.

31.0 : 12.26–8 (82). ALFONSO, J. L. Palo santo: es una valiosa especie indigena. [***Bulnesia sarmientoi* Lor. ex Griseb.: a valuable native species.**] *Mundo maderero* 5 (57), 1944–45 (11–2). [Span.] [1204].

A general account of the species *Bulnesia sarmienti* (Guayacán Verdadero, Guayacán Blanco, Lignum Vitae, Palo Santo, Palo Prieto, Bois de guiac, etc.), taken from the author's book 'Forestales indígenas de la Argentina'. Details are given of the appearance and distribution of the species, and its utilization (principally for charcoal at the present time).

31.0 : 12.26–8 (94) : 33. **Coachwood.** *Wood* 10, 1945 (214–6). [1205].

Little is known of Australian Coachwood (*Ceratopetalum apetalum*), which was first used in any quantity in the manufacture of Mosquito aircraft. Concentrations of this species, previously unrecorded, were located in northern-central New South Wales by aerial photography. Following this, the Forestry Commission in 12 months produced 3½ million super. ft. of timber, including 3 types of plywood. Experiments are now being made to regenerate this species artificially.

31.0 : 12.26–8 (94). **The properties of Australian timbers: Grey Handlewood (*Aphananthe philippinensis* Planch).** *Mon. News Lett. Div. For. Prod. Aúst.* No. 137, 1945 (7). [1206].

31.1. *Structure. Anatomy. Identification*

31.1 : 12.25. BEVERSLUIS, J. R. De micrografische identificatie van conifere houtsoorten. [**The micrographic identification of coniferous woods.**] *Meded. LandbHoogesch. Wageningen* 47 (2), 1943. pp. 39. [Du.] A.P.B. [1207].

The main section of this work consists of a key for identification of timber species of the Pinaceae, Taxaceae, Araucariaceae, Cupressaceae, Taxodiaceae, and Podocarpaceae, based on the microscopic features of the wood. Some of the genera and the species described are later listed under characteristic microscopic features, and an alphabetical list of all species is given, with page references to the detailed microscopic descriptions of the timbers. The species of *Pinus* are classified under the sections *Cembra*, *Paracembra*, *Sula*, *Pseudostrobus*, *Taeda*, *Khasia*, *Australes*, *Pinea*, *Banksia* and *Eupitys*.

31.1. **Color tests for differentiating heartwood and sapwood of certain Oaks and Pines.** *Tech. Note U.S. For. Prod. Lab., Madison* No. 253, 1945. pp. 2. P.R. [1208].

Two chemical colour tests have been developed by which sapwood and heartwood of certain Oaks and Pines can be readily distinguished. Both consist in the application of a chemical solution with a small camel-hair brush across the grain, and both colour the heartwood red and the sapwood yellowish. The chemical solution used on Oak is Taylor's concentrated Benzo Yellow pH indicator, a chemical used for making acidity tests. It gives good results with *Quercus garryana*, *Q.*

alba, *Q. montana*, *Q. rubra*, *Q. borealis*, *Q. velutina*, *Q. coccinea*, and *Q. copeyensis*, but is not recommended for wood exposed to long weathering, treated with preservatives, or infected with stain or decay fungi.

For use on Pine a solution can be made as follows:—Dissolve 5 grams of benzidine in 23 cc. of 25-per-cent. hydrochloric acid and 970 cc. of water, and mix with an equal amount of 10-per-cent. solution of sodium nitrate. The mixture has been found effective on *Pinus echinata*, *P. contorta*, and *P. resinosa* and gives fairly good results on *P. montana*, *P. lambertiana* and *P. ponderosa*.

31.2. *Physical Properties*

31.2 (47.9). VANIN, S. I., and SKABICHEVSKAYA, T. P. Makroskopicheskoe stroenie i fiziko-mekhanicheskie svoystva drevesinȳ nekotorȳkh drevesnȳkh porod Azerbaydzhana. [**The macroscopic structure and physico-mechanical properties of the wood of some Azerbaijan species.**] *Lesnaya Prom.* No. 12, 1944 (11–3). [Russ.] [1209].

Brief data are given on the macroscopic appearance of the wood of *Ulmus foliacea*, *Pyrus communis*, *Quercus iberica*, *Castanea sativa*, *Acer velutina*, *Juniperus foetidissima*, *J. polycarpos*, *Juglans regia*, *Prunus avium*.

Comparing the data for these woods with those for species previously tested, the following close resemblances in physical and mechanical properties are noted:—(1) *Quercus iberica* with *Q. robur*; (2) *Acer velutina* with *A. trautvetteri*, and (3) *Juniperus foetidissima* and *J. polycarpos* with *J. excelsa*.

For each species density, radial and tangential shrinkage, and mechanical strength properties are tabulated.

31.2 : 12.29 (95). **Coconut palm logs: valuable material from Pacific war zone under test.** *Mon. News Lett. Div. For. Prod. Aust.* No. 137, 1945 (3–4). [1210].

Logs from Coconut Palms (*Cocos nucifera*) have been used extensively in the Pacific war zone for all classes of construction. The diameter is usually about 10–12 in. and the height of trees may be as much as 100 ft. but is usually 50–60 ft. In cross section a Coconut log is made up of 3 zones: an outer layer about $\frac{1}{4}$ in. thick of dark brown fibrous tissue resembling bark, surrounding a hard ring about 2 in. wide consisting chiefly of bundles of horny vascular strands set closely together in soft tissue. This layer merges into the central pithy core consisting of scattered bundles of vascular strands interspersed with soft tissue.

The Division of Forest Products, C.S.I.R. has made mechanical tests on logs from New Guinea and the results of tests on the green timber are now available. Average bending strength 6,900 lb./sq. in., with a range of from 4,600 lb./sq. in. to 10,800 lb./sq. in. and an average stiffness of $1{\cdot}56 \times 106$ lb./sq. in. were obtained. Moisture content varied between 50 per cent. and 74 per cent. of the oven-dry weight of the material. Basic density of specimens ranged from 6 lb. to 62 lb./cu. ft., this large variation being due to the very marked variation in texture from the pith to the outside. A variation in crushing strength from 200 lb./sq. in. to 12,500 lb./sq. in. and Izod values from 0·6 ft. lb. to 147 ft. lb. were recorded. The maximum hardness was 65 times the lowest value. Tests on the dry material will be carried out as soon as the specimens reach equilibrium.

31.22. Relation to Water, Air, Gases

31.22.1 : 07.7. **New moisture register for testing on contours.** *B.C. Lumberm.* 29 (8), 1945 (104). [1211].

The new Model K-2 Moisture Register manufactured by the Moisture Register Co., 138 Garfield Avenue, Alhambra, California, is especially adapted for testing paper in stacks or rolls; bolts; rolls or stacks of cloth; rough lumber; plaster or other materials having curved or irregular surfaces. Moisture percentage can be determined by this instrument down to zero per cent. It is portable and weighs only 5 lb.

31.22.2 : 31.23. PAUL, B. H., and LIMBACH, J. P. **Longitudinal shrinkage of Balsa.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1364, 1944. pp. 3 + 4 figs. P.R. [1212].

Investigations were undertaken to ascertain the amount of longitudinal shrinkage of Balsa wood in relation to its moisture content and specific gravity. 238 specimens of Balsa $9\frac{1}{2}$ in. long, $\frac{1}{4}$ in. thick and $\frac{5}{8}$ in. wide were used. They were weighed in an air-dry condition and their length measured to $\frac{1}{1000}$ in. The specimens were then submerged in cold water for 2 weeks and again weighed and measured. Next they were allowed to dry slowly until again air-dry,

when they were placed in an oven at 100° to 105° C. until entirely free of moisture, when the weight and length of each specimen was again recorded. The moisture content of the specimens in their initial air-dry condition ranged from 6·5 to 13·8 per cent. based on their weight when oven-dry, and averaged 8·3 per cent. On the same basis the moisture content in the soaked condition ranged from a minimum of 141 per cent. to a maximum of 792 per cent. and averaged 400 per cent. The moisture content of green, freshly cut Balsa may be estimated at 200 to 400 per cent. The average longitudinal shrinkage of the air-dry specimens was 0·197 per cent.; that of moisture-free specimens was 0·285 per cent. The soaked dimensions of the specimens were practically equal to their dimensions in the green condition, which is the standard used for computing shrinkage values. With one exception, all specimens that shrank more than 0·30 per cent. were below 0·10 in specific gravity. The data show that longitudinal shrinkage up to 0·25 per cent. may be expected for Balsa with a specific gravity of 0·20. A table is given showing relation of longitudinal shrinkage to weight per cu. ft. Longitudinal shrinkage much beyond 0·25 per cent. is considered undesirable for fabricated parts that are to be subjected to considerable moisture fluctuations in use. Careful segregation of Balsa on a weight basis, and the elimination of material considered likely to shrink excessively is strongly recommended.

31.22.2. Barkas, W. W. **Swelling stresses in gels and the calculation of the elastic constants of gels from their hygroscopic properties.** *Spec. Rep. For. Prod. Res. Lab., P. Risborough*, No. 6, 1945. pp. ii + 62. [1213].

This report covers the work done at Forest Products Research Laboratory, Princes Risborough up to May, 1944, on the calculation of the swelling pressures and elastic constants of gel structures from their moisture-absorbing properties. The methods used were developed in the first instance in order to obtain information about the elastic properties of the material of which the cell walls in wood are composed, because wood, being a cellular structure, has external properties very different from those of its solid constituent. The treatment has been kept as generalized as possible and is now presented as a general theory of swelling stresses in gels. The subject of swelling pressures has hitherto been developed as a branch of physical chemistry, but it can equally well be approached from the standpoint of elasticity, and most of the practical problems involving swelling stresses are in fact those connected with the elastic properties of the materials. For this reason, the latter treatment has been followed in this report with the exception of the fundamental equation connecting the mechanical stress with the vapour pressure.

Little work appears to have been done on the swelling pressures of gel materials other than wood, so the applications of the present theory can be illustrated only by data on that material. For this purpose a set of co-ordinated data on Spruce wood has been collected and is used throughout the report. As no precise data exist on the swelling of Spruce from the dry state, the illustrations are drawn chiefly from desorption and shrinkage data. In the last chapter the use of wood as a cellular structure is treated in detail and some elastic constants both of the gel material and of the gross wood are calculated from absorption and swelling data only. *From author's foreword.*

31.27. Mechanical Strength

31.27 : 12.25. Drow, J. T. **Effect of hydraulic-equipment oils on the bending and compressive strength of Sitka Spruce.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1520, 1945. pp. 8 + 9 figs. + tbls. P.R. [1214].

This report presents the results of static bending and compression tests of Sitka Spruce soaked in petroleum-base and castor-oil-base hydraulic fluids at normal temperature. Comparison of results from unsoaked controls and from specimens soaked in petroleum-base fluid shows that the petroleum-oil exposure does not affect the compressive or bending strength to any degree. Soaking in castor-oil-base fluid, however, does reduce the strength properties. The reduction depends upon the degree of impregnation, which is affected by the soaking period in relation to the size of the section. Small thin specimens afford more information as they allow more complete penetration. In compression tests the amount of reduction in strength depends on whether end soaking as well as radial and tangential soaking takes place. *From author's summary.*

31.27 : 12.26–8. Doyle, D. V., Drow, J. T., and McBurney, R. S. **Elastic properties of wood: the Young's moduli, moduli of rigidity, and Poisson's ratios of Balsa and Quipo.** *Mimeo. U.S. For Prod. Lab., Madison* No. 1528, 1945. pp. 16 + plates. P.R. [1215].

Results of tests to determine the elastic properties of Balsa (*Ochroma lagopus*) and Quipo (*Cavanillesia platanifolia*). The Young's moduli and moduli of rigidity for both woods increased with density, while the Poisson ratios for both species showed no relationship thereto. The ratios of the various other elastic constants to E_l (elastic modulus in the longitudinal direction) for Balsa were reasonably uniform for all specific gravities, but showed considerable variation with density for Quipo. A comparison of the various elastic constants for the two species showed that neither Balsa nor Quipo gives consistently higher values. *From authors' summary.*

31.27 : 33.15. Goodell, H. R., and Phillips, R. S. **Bolt-bearing strength of wood and modified wood. Effects of different methods of drilling bolt-holes in wood and plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1523, 1944. pp. 10 + plates. P.R. [1216].

It has been found that many factors affect the behaviour of a bolt in bearing on a block of wood or plywood, two of the most important being type of drill used and the rate of feed when drilling. The tests reported in this paper, in which ¼-in. boltholes were bored in Douglas Fir plywood and ½-in. holes in Sitka Spruce wood, show that (1) bolt holes with visibly smooth side walls have bolt-bearing properties far superior to those with visibly rough side walls; (2) in order to produce a smooth hole, the drill must be well sharpened and the rate of feed in drilling must be slow enough to enable the drill to cut rather than tear its way through the piece; and (3) in the materials used, the twist drill produces a smoother hole than does a machine bit. The results of the tests are illustrated with photographs.

31.27 : 12.26–8. Stern, E. G. **Resistance of common hardwoods to compression perpendicular to the grain.** *Bull. Va. polytech. Inst.* 37 (8), 1944. pp. 29. [*Engng. Exp. Sta. Ser.* No. 57.] P.R. [1217].

The woods used in these experiments were air-dried White Oak (*Quercus alba*), Red Oak (*Q. borealis*), Chestnut Oak (*Q. montana*), Bitternut Hickory (*Carya cordiformis*), White Ash (*Fraxinus americana*), Hard Maple (*Acer saccharum*), Beech (*Fagus grandifolia*) and Yellow Poplar (*Liriodendron tulipifera*). Data are presented on moduli of elasticity and stresses at proportional limit in compression perpendicular to the grain, as influenced by physical structure, moisture content and temperature of the wood, rate of strain, duration of stress and repeated loading. The results of the tests are given in a series of tables. Both stresses at proportional limit and moduli of elasticity in compression perpendicular to the grain for the species tested are similarly influenced by specific gravity, physical structure, decrease in moisture content and temperature of wood. Thus increase in specific gravity, decrease in moisture content, and decrease in temperature result in similar increases in the two strength properties. Variations in rate of strain within the limitations of the tests performed and repetitive stressing within the lower elastic range seem to have no appreciable influence on the strength properties. Creep of the wood is not observed within the lower elastic range.

31.3. *Chemical Properties*

31.3. Wise, L. E. [Editor]. **Wood chemistry.** Reinhold Publishing Corporation, 330 West Forty-second Street, New York. 1944. pp. x + 900. Price $11.50. [1218].

One of a series of monographs produced by the American Chemical Society, the aim of which is firstly to present the knowledge available upon the chosen topic in a form intelligible to those whose activities may be along a wholly different line, and secondly to promote research by furnishing a well digested survey of the progress already made and pointing out directions in which investigation needs to be extended. The present book is more than an expansion of Monograph 28 'The Chemistry of Wood' by Hawley and Wise, 1926. Thirteen authors have contributed to it, each dealing with one or more of the following subjects:—the growth, anatomy and physical properties of wood; the components and chemistry of the cell wall (cellulose, its constitution, properties and derivatives, hemicelluloses and lignin); the extraneous components of wood; surface properties of cellulosic materials; the chemical

analysis of wood (determination of cellulose, pentosans, hexosans, lignin and miscellaneous materials); wood as an industrial raw material (combustion, thermal decomposition, delignification and decomposition of lignin, cellulose and hemicelluloses by micro-organisms). Each of the 25 chapters has its own bibliography.

31.3 : 33.3 : 34.6. Risi, J. **The chemical utilization of wood: a short review and progress report.** *Pulp Paper Mag. Can.* 46, 1945 (611–8). [Ecole d'Arpentage et de Génie forestier, Laval Univ., Quebec.] [1219].

31.3 : 34.6. Lewis, H. F. **Lignin: an economic liability or a chemical asset.** *Chem. Engng. News* 23, 1945 (1074–80). [Inst. of Paper Chemistry, Appleton, Wis.] L.S. [1220].

A general review of the sources, chemical properties, and actual and potential uses of lignin. Most of the work done on the subject has been in connexion with waste from sulphite pulping, which is estimated to amount to 2½ million tons annually in the United States and Canada. A new source of lignin is the process of wood saccharification. The types of lignin, their physical and chemical properties are dealt with in some detail. Various forms of utilization are described, including adhesives, briquettes, cement, ceramics, core binders, insecticides, dyes and dying, electroplating, emulsions, fermentation, fertilizers, plastics, road treatment, soaps, tanning agents, and vanillin. Many of these are still only in the experimental stage and it is emphasized that much more research is necessary, particularly on the structure of lignin, before this vast potential supply of raw material can be adequately utilized.

31.3 : 12.25 : 34.26 (469). Sousa Monteiro, A. Subsídio para o estudo de composição química da madeira do *Pinus pinaster* Sol. Influência da resinagem. [**Aid to the study of the chemical composition of the wood of *Pinus pinaster* Sol. Influence of resin tapping.**] *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (449–50). [Port.] E.M.B. [1221].

Studies made of the chemical composition of the wood of *Pinus pinaster* and the influence on it of the different systems of resin tapping in current use in Portugal gave (under conditions used in the experiments) the following results: (1) the oleoresins and the cellulose predominate in the sapwood; (2) the carbohydrates, the lignin and the total cellulose predominate in the heartwood; and (3) tapped trees exhibit higher percentages of oleoresins, carbohydrates, lignin and cellulose.

31.3 : 12.25. Brauns, F. E., and Buchanan, M. A. **Acetic acid Spruce lignin and acetic acid Willstätter Spruce lignin.** *J. Amer. chem. Soc.* 67, 1945 (645–9). L.S. [1222].

Acetic-acid Spruce lignin and acetic-acid Willstätter Spruce lignin have been compared with isolated native Spruce lignin. It is found that the number of hydroxyl groups is the same in all cases, indicating that no new hydroxyl groups are formed when lignin is extracted from Spruce by means of acetic acid. *From authors' summary.*

31.3 : 12.25. Brauns, F. E. **The nature of lignin from Western Hemlock (*Tsuga heterophylla*).** *J. organ. Chem.* 10, 1945 (211–5). L.S. [1223].

In connexion with a study of the chemical composition of western woods, the lignin from Western Hemlock (*Tsuga heterophylla*) was studied and compared with that from Black Spruce (*Picea mariana*). Two types of lignin were investigated: so-called native Hemlock lignin and Willstätter or hydrochloric-acid lignin. The yield from Western Hemlock was found to be very nearly the same as that from Black Spruce, and the various lignins from Western Hemlock have the same number of methoxyl groups per lignin building unit as the corresponding lignin derivatives from Black Spruce, and also the same number of hydroxyl groups capable of methylation with diazomethane.

31.3 : 12.25. Brauns, F. E. **The occurrence of conidendrin in Western Hemlock (*Tsuga heterophylla*).** *J. organ. Chem.* 10, 1945 (216–8). L.S. [1224].

Conidendrin has been isolated from Western Hemlock (*Tsuga heterophylla*) and identified by its acetyl and methyl derivatives. Benzoyl and *p*-toluene-sulfonyl conidendrin have been prepared. The ultraviolet absorption spectrum of conidendrin has been determined. *Author's summary.*

31.3 : 12.25 : 34.6. Pearl, I. A. **Conidendrin from Western Hemlock sulfite waste liquor.** *J. organ. Chem.* 10, 1945 (219–21). L.S. [1225].

Ether-extraction sulphite waste liquor from Western Hemlock (*Tsuga heterophylla*) produced a yield of 1·1 grammes of conidendrin per

litre of digester-strength sulphite waste liquor, which is higher than that from the original wood by solvent action, and also considerably higher than that from *Picea excelsa* waste liquor. The results indicate that the sulphite liquor from Western Hemlock offers an unlimited, readily available source of large amounts of relatively pure conidendrin for further research. Studies on the reactions of conidendrin and on its isolation from pulping liquors from a large number of woods are in progress.

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

31.42.1 : 33.02 : 12.25. HEPTING, G. H. **Decay and staining of Southern Pine pulpwood.** *Paper Ind.* 27, 1945 (379–82). L.S. [1226].

Decay in pulpwood results in loss of weight and structural breakdown of the wood. The extent to which the yield and quality of pulp from decayed wood are affected depends on the fungi causing the decay and the extent of decay. The chief conditions of decay in Pine pulpwood are poorly aerated ricks and bad drainage. Well spaced ricks, good drainage and yard sanitation will do much to prevent decay in stored wood. Blue-stain in pulpwood results in darkened pulp and entails the use of considerably more bleach than for sound wood pulp. The recommendations for the prevention of decay are also applicable to blue-stain. The only way entirely to avoid decay and blue-stain is prompt utilization of the wood after felling. As small a supply of wood as possible should be kept in the yards, and continually replaced by fresh wood, which should not be stacked on top of old wood. Chemical treatment for stain prevention is possible, but it is doubtful whether it would be economically practicable. In the case of unpeeled wood, anti-stain chemicals would not be certainly effective, as they do not repel beetles, which introduce the stain fungi through the bark, regardless of the chemical on the outside.

31.42.1 : 33.8 : 31.22.1. HIRT, R. R. **Moisture content of wood boats.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 18, 1944. pp. 12. P.R. [1227].

General information on the causes of absorption of moisture in fresh-water boats, together with tables showing moisture content at certain specified points for boats which have been out of the water for differing times. The moisture content of different species of wood varies with the ability of the particular wood to absorb water and the different rates at which the moisture penetrates. Plywood absorbs water relatively fast because usually at least one of the inner plies in boats has the grain perpendicular to the grain of the adjoining plies. Poor ventilation during service encourages moisture absorption and may be an important factor in the rapid spread of wood-rot fungi and consequent decay. Water-resistant and preservative treatment, proper construction, supervision, repair and good ventilation during storage and service will do much to remove the danger of decay through excessive and prolonged moisture absorption.

31.42.11. FINDLAY, W. P. K. **Some factors influencing the rate of decay in wood.** *Chem. & Ind.* No. 7, 1945 (55). P.R. [1228].

Decay is caused almost entirely by the action of higher fungi, producing enzymes which break down lignified cellulose. The rate of decay depends on the species of fungus, physical condition and species of wood. Those fungi which cause brown and white rot are the principal causes of wood decay. The most important physical condition influencing the rate of decay is the moisture content of the wood. Sapwood of most species of wood decays readily, whereas dark-coloured heartwood is much more resistant. Density of a timber has only a minor influence on resistance to decay. The author stresses the need for further research in natural preservative substances, both in their constitution and in their distribution in various timbers.

31.42.11 : 33.51 : 12.21. FRITZ, C. W. **Does depth influence rate of decay in mine timber?** *Repr.* from *Canad. Mining J.* Nov., 1942. pp. [2]. [1229].

It is sometimes found that timbers installed in very deep workings in a mine decay less rapidly than those in the upper levels. A case in which marked difference in the rate of decay at different levels was noted, was investigated by the Forest Products Laboratory, Ottawa. The timbers investigated were in service in the mine of the Kirkland Lake Gold Mining Co., Ltd., Kirkland Lake, Ontario. A long drift had been driven at a depth of 5,450 ft. some

7 or 8 years previously and then abandoned. When mining was resumed at this level it was found that the timbers (squared, untreated Douglas Fir) were sound. Similar timber at upper levels had decayed rapidly. The most important agent causing decay at upper levels in this mine is *Merulius lacrymans*. This fungus is excluded from the 5,450-ft. level by the high temperatures prevailing. Other wood-rotting fungi were excluded from the timbers in question by the dryness of the wood. Depth influences timber decay only in so far as it provides temperature and moisture conditions favourable or unfavourable to fungi introduced into the mine.

31.42.11 : 12.21 : 33.36.1 : 38.2. CARTWRIGHT, K. ST. G., and FINDLAY, W. P. K. **Dry rot in wood.** *Bull. For. Prod. Res., Lond.* No. 1, 4th ed., 1945. pp. 32. [1230].

Part 1 of this bulletin treats of the fungi causing dry rot in wood, the conditions necessary for fungus growth, the spread of dry-rot fungi, and the resistance of timbers and other building materials to dry rot. There is a brief account of other fungi occurring in houses and a table for diagnosis of fungi causing decay of timber in buildings. Part 2 deals with the detection and practical treatment of dry rot, including the application of paint and preservatives. Part 3, most of which is new in this edition, deals with precautions to be taken in the use of timber in new buildings in order to prevent outbreaks of dry rot.

31.42.11: 38.2 (71). **Technical note: Prevention and control of decay in wooden buildings.** Forest Products Laboratories, Dominion Forest Service, Ottawa. 1942. pp. 4. [1231].

This note deals with untreated wood only, and applies to climatic conditions obtaining in Canada. Suggested precautions against decay are the use of tar-paper on the ground under a building, avoidance of contact between wood blocks or posts and the ground, provision of good ventilation under the ground floor, choice of a well drained site, use of well seasoned timber, a good roof, closely fitting woodwork, low humidity within a building, double windows, prompt repair of faulty plumbing. Exterior woodwork should be kept well painted. If, in special circumstances, it is necessary to use wooden members in situations favourable to decay, decay-resistant woods, such as heartwood of Cedar, should be used.

31.42.12 : 12.26–8 : 31.27. HANSBROUGH, J. R. **The significance of black line stain in Yellow Birch propeller lumber.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 23, 1945. pp. 3 + tbl. P.R. [1232].

The study here reported was made to determine the cause of black-line stain in Yellow Birch and its significance in terms of reduction in toughness.

Standard-size specimens $\frac{3}{4}$ in. $\times$ $\frac{3}{4}$ in. $\times$ 12 in. of planed kiln-dried lumber with black-line stain were tested in comparison with closely matched control specimens, all having a moisture content between 7·5 and 10 per cent. The difference between stained and control specimens in toughness and specific gravity was too slight to be of real significance. It may, however, be desirable to continue to reject black-line-stained stock as the storage conditions favourable for the development of black-line stain fungi also favour development of decay fungi. Even the early stages of storage rot in specimens tested caused a 14-per-cent. reduction in toughness.

Methods of controlling black-line stain by dipping are indicated.

31.43. Attack by Animal Organisms

31.43 (931) : 13.2. KELSEY, J. M., SPILLER, D., and DENNE, R. W. **Biology of *Anobium punctatum*.** *N.Z. J. Sci. Technol.* 27B (1), 1945 (59–68). P.R. [1233].

The report describes the techniques used in rearing the borers with the object of utilizing them to evaluate timber therapeutants. Air- and kiln-dried *Pinus radiata* and Rimu (*Dacrydium cupressinum*), kiln-dried Tawa (*Beilschmiedia tawa*), Matai (*Podocarpus spicatus*) and Totara (*Podocarpus totara*) were infested with eggs and stored under room conditions. Although the number of eggs laid per female in all these timbers was not significantly different, the size of the larvae did differ very considerably, which indicates that timber species affect the rate of development and possibly the length of the life cycle. The beetle also attacks wood-fibre wallboard and cardboard filler, but it is not yet known whether the life cycle can be completed therein.

31.43 (71.21) : 31.45 : 43.3 : 12.25 : 13.2. RICHMOND, H. A., and LEJEUNE, R. R. **The deterioration of fire-killed White Spruce by wood-boring insects in Northern Saskatchewan.** *For. Chron.* 21, 1945 (168–92 + plates). [Forest Insect Investigations, Winnipeg, Manitoba.] [1234].

For successful salvage of White Spruce (*Picea glauca*) sawtimber and pulpwood killed and damaged by fire and wood borers, the rates of deterioration by borers were worked out during the summer months of 1941–43. The paper is largely confined to an analysis of the injury produced by round-headed borers, chiefly the white-spotted sawyer, *Monochamus scutellatus*. Shallow - boring, round - headed borers of *Tetropium* species were associated with it.

Five distinct types of fire-killed trees were segregated, each type being differently affected by wood-borers:—Type 1, the most severe of all burn types, bark burned thin, brittle, fails to bend without breaking, wood dry and brown, was permanently immune; Type 2, bark badly charred, thin, but pliable when first burned, was the earliest attacked; Type 3, bark blackened but of normal thickness, inner bark moist and pliable, showed the greatest degree of borer damage; Type 4, found on partly burned trees subjected to reflected heat, external appearance normal, cambium moist but with signs of drying, and Type 5, roots only injured by fire, were the last to become infested and showed shallowest average penetration at any date. A distinct correlation was found between burn types and the chronological sequence of attack, the relative depth of penetration at a given date during boring activities, and the larval mortality. Mill studies showed that the greatest over-all damage was sustained by Type 3 logs, and the greatest number of holes in the outer board occurred in Type 5 logs. This was due to the greater proportion of *Monochamus* in Type 3 logs, and the larger population of shallow borers in Type 5. In this latter type, the edging of subsequent boards removed the majority of holes. Diameters and heights showed insufficient relation to borer infestation to warrant consideration from the standpoint of salvage. The checking of logs, particularly those that eventually lose their bark (Types 1, 2 and 3), during the second summer, was as great a contributing factor to deterioration as were the borers.

The following recommendations are made. The salvaging of fire-killed timber should be started as soon as possible after the fire, but it is erroneous to assume that all is lost if salvage work be not completed in the first winter following the fire. To salvage in the second winter is to utilize the timber before the maximum damage has resulted, especially in the case of trees carrying unburned bark (Type 5). Trees burned in early summer will experience the main infestation that season. Additional infestation will probably develop in the second summer, especially in the Type 5 class. Types 2 and 3 are the earliest infested. Type 1 is permanently immune to *Monochamus*, but is the first to undergo severe checking. Where selective logging can be practised, it is advisable to cut first those trees with blackened bark (Types 2 and 3). The root-burned trees with uninjured green foliage (Type 5) offer the best-quality lumber and the longest salvage period. Their main borer damage should not be noticeable in lumber until the second season after the fire. Beyond the second summer, checking may become a greater factor in deterioration than borers. Estimates made immediately after a fire of the probable future loss from borers must take into account the variety of species infesting the logs. Because of the difference in the depth of boring of various species, any appraisal at that time, based only on holes visible on the surface of the wood, might be very erroneous and unduly alarming. The salvaging of fire-killed timber has proved practicable and profitable under prevailing conditions, and the quality of lumber cut far exceeded expectations.

These recommendations are based on the behaviour of borers in White Spruce as encountered in northern Saskatchewan. Different conditions would cause variations in activity and species but the fundamentals would probably be the same.

31.43 : 12.26–8 : 13.2. HOGAN, T. W. **Pinhole borers of fire-killed Mountain Ash. I. Survey and field observations.** *J. Dep. Agric. Vict.* 42, 1944 (513–20, 524). L.S. [1235].

Among the factors causing deterioration of fire-killed Mountain Ash (*Eucalyptus regnans*) and Alpine Ash (*E. gigantea*) in Victoria are pinhole borers. This paper reports on an investigation of the types of borers present, the

damage caused by them, the extent and progress of the infestation in relation to methods of salvage used, and certain factors that appear to influence the degree of infestation. The two types of borers causing damage are Platypodids and Lymexylids.

31.43 : 31.1 : 31.3 : 12.26–8 : 33.8. FRISON, E. De la présence de corpuscules siliceux dans les bois tropicaux en général et en particulier dans le bois du *Parinari glabra* Oliv. et du *Dialium klainei* Pierre: utilisation de ces bois en construction maritime. [**The presence of siliceous bodies in tropical woods generally, and in particular in the wood of *Parinari glabra* Oliv. and *Dialium klainei* Pierre. Utilization of these woods in marine construction.**] *Bull. agric. Congo belge* 33, 1942 (91–105). [F.] [1236].

There are two species of timber which have, up to the present, proved immune to teredo attack. The first of these is Demerara Greenheart (*Nectandra rodioei*), which owes its immunity to the presence of an alkaloid (nectandrine) which kills the teredo after a superficial attack; it is imported from Dutch and British Guiana and is much used for wharfs, etc. The second species is Azobé (*Lophira procera*), a native of Gabon, Cameroons and Belgian Congo, but there is insufficient evidence to show whether this wood has a real immunity. In Dutch Guiana, successful use has been made of Manbarklak (*Eschweilera* sp. [*longipes ?*]). This wood contains up to 1·73 per cent. of siliceous bodies in the medullary rays, and it is this very hard, amorphous silica which protects the wood effectively against the action of the teredo. Experiments with various species, made in Dutch Guiana by the Dutch forester Gonggryp, proved conclusively that a species containing at least 0·50 per cent. of siliceous bodies is practically immune to teredo attack. In the light of these facts, the author investigated two species from the Belgian Congo, *Parinari glabra* and *Dialium klainei*, which were found to contain 2·73 and 1·16 per cent. respectively of silica, and which are accordingly recommended to the attention of engineers and wood technicians. He also made microscopic examinations of about 1,000 samples of wood from about 730 species, and found 72 to contain siliceous bodies. In 43 of these, the percentage of silica appears to exceed 0·5. A list of these species is given, with scientific and vernacular names and provenance. Up to the present all the species in which these bodies have been found are from tropical countries, whilst species from the temperate zone are free from them.

31.45. Injury by Fire

31.45. MCNAUGHTON, G. C. **Ignition and charring temperatures of wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. R1464, 1944. pp. 3 + 1. P.R. [1237].

Results of tests to show the effect of temperature and time of exposure upon the ignition of Longleaf Pine, Red Oak, Tamarack, Western Larch, Noble Fir, Eastern Hemlock, Redwood, Sitka Spruce and Basswood. With prolonged exposure at all temperatures used there was a gradual darkening of the wood accompanied by loss of weight and shrinkage in the transverse dimensions of the specimens. Chemical destruction, as indicated by loss of weight, was not associated with any one critical temperature. Samples changed colour and characteristics but none was ignited during its exposure. A summary of weight losses and transverse shrinkage of Hard Maple specimens during oven heating at different temperatures is appended.

31.8. *Quality and Defects of Timber*

31.8 : 12.25 : 31.27 : 31.42.1. ENGLERTH, G. H., and HANSBROUGH, J. R. **The significance of the discolorations in aircraft lumber; Noble Fir and Western Hemlock.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 24, 1945. pp. 10 + plates. P.R. [1238].

A survey was made in Oregon and Washington of the discolorations occurring in Noble Fir (*Abies nobilis*) and Western Hemlock (*Tsuga heterophylla*) wood, and the present report is presented as an aid in the inspection of these woods for aircraft and other high-grade lumber. The following discolorations are not indicative of decay and represent no significant loss in strength: black streak, chemical stain, radial red streaks or strawberry marks, machine burn, vertical purple and red streaks, resin streak, bluish cast of outer heartwood, flocco-soids or white flecks, surface moulds. The following discolorations are caused by staining or wood-destroying fungi and are reasons for rejection of lumber: blue-stain, brown streaks, bands or zones, brown spots, red bands or zones,

white to yellow pits or pockets, black specks, brown flecks, zone lines.

31.8 : 12.25. RENDLE, B. J. **Strawberry mark in Sitka Spruce lumber.** *Sci. tech. Mem. Minist. Aircraft Prod.* No. 6/45 FP.23 RIS.28, 1945. pp. 2 + plate. P.R. [1239].

Strawberry mark, a defect of Sitka Spruce timber, is a reddish-brown patch, up to $1 \times 1\frac{1}{2}$ in. in size, running radially through the wood. It is due to abnormal deposits of resin in the ray cells, and does not always affect the wood structure, although in some cases the rays are greatly enlarged, thus reducing the strength of the wood. There may also be a slight deviation in grain.

32. HARVESTING OF WOOD. LOGGING

32 : 07.7 (47.0). SALTȲKOV, M. I. Sostoyanie i perspektivȳ mekhanizatsii lesozagotovok. [**Present state and prospects of mechanization of logging work.**] *Lesnaya Prom.* No. 12, 1944 (3–6). [Russ.] [1240].

According to Russian data, the time taken to log, extract and load 1 cu.m. of timber on to wagons was 1·6 man-days in 1940, 1·58 in 1941, 2 in 1942, and 1·85 in 1943: the average production per man per day was thus 0·50 cu.m. At the same time in America, the daily output per man varied from 4 to 7·5 cu. m., taking into account all phases of the work, viz. felling, trimming, assembly of logs, conversion, and all preliminary work for extraction and loading. This difference in output is attributed to the higher growing stock per ha. in most American forests, which makes mechanization, and especially transport methods, much simpler. In the U.S.S.R. 60 per cent. of the time is spent in logging and extracting and 40 per cent. in transport, owing to the lack of mechanization in felling, conversion and extraction.

The average annual domestic demand for timber in post-war Russia is estimated at about 250 million cu.m. With 250 working days in a year and an average daily output of 1 million cu. m., 2 million men would be needed, but this is out of the question without mechanization.

Heavy (33–86 kg.) motor power-saws of American types are unsuited for Russian conditions, as are heavy tractors. Consequently two light-weight (13–17 kg.) types of power-saw have been designed, also a small 7·5 kw. power-unit, capable of supplying power for 3 electric saws and mounted on a cross-country motor vehicle and driven by the engine of the vehicle. A new light tractor with a clearance of 60 cm. is being developed.

32 (47.8) : 31.8 : 21 : 12.25 : 23.1 : 43. TKACHENKO, M. E. Ratsionalizatsiya lesnȳkh zagotovok na Urale v svyazi s oboronoy stranȳ. [**Rational logging in the Ural in connexion with the defence of the country.**] *Lesnaya Prom.* No. 4–5, 1944 (3–8). [Russ.] [1241].

A report on a tour of inspection of forests in the Karpinsk region, Trans-Ural.

(1) In a comparative study of Larch and Scots Pine in a 175-year-old stand, the mean stem of Larch exceeded that of Pine by 5 m. in length and 3 cm. in diameter, the mean volume per stem being 1·2 cu.m. for Larch and 0·8 cu.m. for Pine. Larch was less subject than Pine to fungal diseases, and had a lower percentage of defects and greater fire resistance (fire wounds, after the same fire, one quarter those of Pine). Of total trees per ha. 5 per cent. were dead standing Larch and 17 per cent. dead standing Pine; and of fallen stems (90 cu.m. per ha.) 2·8 per cent. were Larch, 16 per cent. Pine and 70 per cent. Spruce. The chief defects of Larch stems were epicormics, rots due to *Polystictus abietinus* and *Trametes abietinus*, and 'bottle' butt. The first two of these occur after fire. With careful cross-cutting a Larch stem heavily infected with *T. abietinus* yielded one I-grade 'aircraft log' 4·5 m. long and 36 cm. in diameter, a I-grade sawlog 5·5 m. long and 36 cm. in diameter, and a III-grade sawlog 3·5 m. long and 29 cm. in diameter. A second stem infected with *Polyporus sulphureus* at the butt had been classed as II-grade sawlog timber, but actually yielded two II-grade 'aircraft logs', one II-grade sawlog 6·5 m. long and one III-grade sawlog 5·5 m. long. In contrast to Pine, Larch often furnishes two 'aircraft' logs per stem. The 175-year-old stand had 40 Larch and 34 Pine per ha. suitable for aircraft timber; for a 225-year-old stand the corresponding figures were 20 and 7 per ha., respectively.

In the 175-year-old stand 17 per cent., and in the 225-year-old stand 40 per cent. of the Larch stems were more or less defective; but though the younger stand yielded a greater percentage of first-grade timber, the total percentage of merchantable timber was the same in both stands. In Larch stems showing

twisted grain the twist decreased from the periphery towards the centre, and the more pronounced the defect at the periphery, the more rapid was this decrease.

The annual increment of the 175-year-old stand approximated to that of the Volga forests of the European part of the U.S.S.R. In the old-growth stands of the N. European U.S.S.R., the Urals and Siberia, much timber classified as overripe is in fact of very high value; the first category for felling should consist only of trees in which increment is exceeded by the development of defects.

(2) *Pinus sibirica* grows on a variety of sites from skeletal gravel soils on dry, rocky, mountain slopes to moist alluvial valley soils and even boggy places; its tolerance of water-logging and oxygen deficiency is greater than that of Scots Pine, and it has been known to remain healthy and furnish joinery timber in places where the latter species is scarcely fit for pitprops. However, *P. sibirica* is almost as pronounced a shade-bearer as Spruce and Silver Fir; as such, it has often a cylindrical crown occupying 70 per cent. of the stem, and natural pruning is very poor, the first dead branches being as low as 1·25–1·75 m. from the ground, so that the wood is extremely knotty and seldom of use for aircraft timber.

Its wind resistance is much higher than that of other native conifers, but where winds are strong the resulting excentricity of annual rings may be such that a stem of 40 cm. diameter has a radius of 26 cm. on the leeward and 14 cm. on the windward side. In boggy sites it regenerates on rotten stumps, logs, and other small elevations, and is subject to butt rot; a 220-year-old stand showed that about 90 per cent. of the trees had butt rot to the height of 1·5–2 m. The seeds are edible and it is recommended that poor seed yielders should be cut for fuelwood.

(3) Slash disposal: (*a*) In stands where second-storey Spruce and Silver Fir impede regeneration of light-demanders such as Pine and Larch, slash should be burnt in heaps (150–200 per ha.), first salvaging the larger pieces for fuelwood and III-grade timber. Burning in fewer and larger heaps causes soil deterioration and prevents regeneration for 8–10 years on the burnt patches, while broadcast burning favours Aspen and *Calamagrostis epigeios*, which also prevent regeneration of Pine and Larch. (*b*) In damp valley types where regeneration takes place on rotten wood and small elevations, slash should be heaped and left unburnt to increase the number of elevations. (*c*) In the dry Pine/*Vaccinium vitis-idaea* type, especially on skeletal soils on southern slopes, slash should be scattered and left unburnt to help prevent erosion and add humus to the soil: in this case there is greater fire danger and fire breaks should be made.

(4) Regeneration: Strips of seedbearers are regarded as undesirable since in many cases they are subject to windthrow. Where regeneration of knee height is not present, 20–25 seedbearers should be left per ha., and these should be trees selected for wind-firmness. Excessive tractor skidding over the same ground causes soil compaction and should be avoided. Regeneration was mostly satisfactory except on some southern slopes where repeated fires had occurred.

(5) Fires: The inadequacy of fire control in the area is shown by the fact that 10,000 ha. were burnt over in 1938. Improvements in control are suggested.

32 (57) : 09.7. GULYAEV, L. I. Organizatsiya lesozagotovok v lesakh Kazakhstanskogo Altaya. [**Organization of logging in the forests of the Altai Mountains of the Kazakhstan S.S.R.**] *Lesnaya Prom.* No. 12, 1944 (6–8). [Russ.] [1242].

The Altai region of East Kazakhstan has large forest resources, but owing to poor logging methods the supply of timber from these regions is insufficient; improved logging and extraction methods would avoid the necessity of bringing timber from Siberia. Terrain is very mountainous with ridges up to an altitude of 2,670 m., intersected by rivers. The forests are scattered over the steep mountain slopes, rendering logging and extraction operations very difficult. In view of this and of the lack of roads or railways, mechanized transport is impracticable, and it is proposed to make wider use of the numerous rivers for floating timber out, improving them where necessary.

The article deals chiefly with an experimental method of logging and extraction carried out in the Zȳryansk lespromkhoz, which has a total area of 253,673 ha., and 91,512 ha. under forest, chiefly distributed on the slopes of the mountains between 600 and 1,400 m. altitude, with a growing stock per ha. of 45 cu.m. (based on total land area) or 128 cu.m. (based on forested area).

The operations were carried out by a 'composite brigade', which did all the work from the construction of the contour roads to the delivery of produce at the rivers, hauling by sledge instead of the usual skidding, which involves stacking and reloading. This method doubled the output. Similar operations are planned in other forests of the Altai.

32 (66.7). WILLS, J. A. **Notes on mahogany logging industry.** *Farm and Forest* 6, 1945 (16–20). [1243].

These notes are concerned with the Mahogany logging industry in the Gold Coast, with particular reference to war-time controls. Logs below a certain standard may not be exported and a contractor should be able to grade logs according to their suitability for export. Second-grade logs can be sold to the sawmills or pit-sawyers. Under the Timber Production Ordinance of 1907, it is an offence to fell a Mahogany tree which is less than 9 ft. in girth at 1 ft. above the base of the tree or the convergence of the buttress roots, if these are present.

32 : 12.26–8 (77.6) : 33.32. SCHANTZ-HANSEN, T. **Harvesting young Aspen on the Cloquet Forest.** *J. For.* 43, 1945 (506–7). [Division of Forestry, Univ. of Minnesota.] [1244].

The area of Aspen (*Populus tremuloides*) in the Lake States is variously estimated at from 10 to 21 million acres, much of which is of poor quality. The Wood Conversion Company of Cloquet has been utilizing this material for the manufacture of wallboard with satisfactory results; bark as well as wood is utilized, which makes it possible to use material down to 3 in. d.b.h. Wherever there is a profitable local market for low-grade material of this type, the Aspen may well be perpetuated; clear-cutting on a relatively short rotation is the method suggested.

32.2. *Felling and Related Operations*

32.25.5. WHITE, A. R. **Removal of bark from trees.** *U.S. Patent* No. 2,324,968, July 20, 1943. Brit. Abstr. BIII, 1945 (183). P.R. [1245].

The tree is girdled so as to expose the cambium and sapwood. A cut is made at the bottom of the girdle to a depth of 3 annual rings. To this cut is applied a 3:1 $CaCl_2$/$NaClO_3$ mixture, as a paste or on an absorbent fabric; these salts rise in the sap to the crown of the tree and then fall in the cambium or cortex layer, causing shrinkage and thus allowing easy removal of the bark.

32.29.1 (43.1–5). GOETZ. Rückschau auf die Vorführung von Stockrodeverfahren im Lehrforstamt Eberswalde am 16. Dezember 1942. **[Review of the process of stump removal in the Eberswalde instructional forest on 16 December, 1942.** *Allg. Forst- u. Jagdztg.* 120, 1944 (77–83). [G.] [1246].

Two different procedures were evolved; the purpose of the first was simply to extract the stumpwood while leaving in the ground as much as possible of the roots, and that of the second was to find a simple, productive, reliable and economic process which would leave the newly cleared ground in good condition.

The first procedure consisted in applying a strong explosive charge (in this case donarite) to the taproot, about 40 cm. beneath the surface of the ground. The charge was fired by a cartridge with a detonator and sufficiently long fuse. The explosion shatters the roots near the charge and splits the stump into several pieces, which are held in the earth by outlying roots. The earth is loosened over an area of about 1·5 m. diameter and 80 cm. depth, and the pieces of stumpwood are then extracted by the aid of axe, spade and hand. The roots remain in the ground. It takes 8 to 10 stumps of medium to poor timber trees to provide one stacked cubic metre of stumpwood. The explosive costs 0·80 RM per stump. The total cost of extracting one stacked cubic metre of stumpwood is variously estimated at 10 to 14 RM.

The essence of the second procedure is that it makes use of the force of gravity of the standing tree to raise the whole root system out of the ground and so eliminate grubbing-out operations. For this purpose the stem is excavated only enough to display the horizontal surface roots, which are severed at a distance of 60–80 cm. from the stem. In light soils even this is unnecessary. The tree is then pulled down by a grubbing machine of the Waldteufel or similar type. Details are given of the process, e.g. height at which the cable should be attached, dimensions of the trestle on to which the tree is felled When the tree is down, any earth can easily be knocked away from the roots

by hand, and falls into the hole left by the extraction. The roots are then trimmed off with axe or saw, and the stump sawn off from the log. A hole is drilled in the sawn-off face of the stump, a small explosive charge inserted, and the explosion splits the stump into several pieces. It is estimated that the cost of extracting stumpwood by this method is 2.4–2.7 RM per stacked cubic metre. Besides its cheapness, this method has the advantage of leaving the ground in good condition.

32.7. *Loss in Logging. Incidental Waste*

32.7 : 32.29 : 34.6 : 76.1. GRANTHAM, J. B. **Recovery of forest waste.** *Timberman* 46 (8; 10), 1944–45 (56–8, 80; 43–4, 46–7, 58). [Oregon Forest Products Laboratory, Oregon State College, Corvallis, Ore.] [1247].

This article reviews previous attempts at re-logging, and describes a co-operative re-logging study carried out in 1944 by a lumber company in the Willamette Valley and the Oregon Forest Products Laboratory. The plan of recovery was to re-log direct to a converting unit, and to convert the salvaged material to primary forest products in the woods. The second part of the study (woods conversion) has not yet been undertaken, but data are presented on the quantity and kind of waste recovered, yarding costs, and value of products.

The quantity of forest waste recovered confirms the findings of previous investigators that the potentially useable material remaining on the ground after logging in the Douglas Fir region amounts to approximately 20 per cent. of the original stand. The test recovery of 26,480 bd. ft. per acre was made in an area closely logged in 1943; the recovery did not include any material less than 8 ft. in length; minimum diameters were 4 in. for Hemlock and Cedar and 8 in. for Douglas Fir.

On the basis of this study, it is estimated that the costs of yarding forest waste, under conditions similar to those encountered, would be $3.91 per thousand bd. ft. or $2.17 per cord. The total estimated value at the landing of the products derivable from the recovered waste was $1715.77, or $483.31 for the waste from one acre. Deducting the logging cost of $103.54 per acre, the margin for converting the waste material to primary products was approximately $380 for each acre re-logged.

The appearance of the experimentally re-logged area, from a standpoint of low slash hazard and good seedbed condition, indicates additional values for this type of salvage operation.

32.7 : 33.06 : 32.25. TRYON, H. H., and SMILEY, D. **Chips or sawdust?** *J. For.* 43, 1945 (654). [Black Rock Forest, Cornwall-on-Hudson, N.Y.] [1248].

A preliminary study was made to determine the percentage of waste from chips in chopping fuelwood with an axe. For the purposes of the study only cylindrical sticks, 4 ft. long, were considered and the slanting face of the cut was assumed to make an angle of either 45° or 60° with the diameter of the stick. The following table shows the computed figures for 45° and 60° angles of cut for several diameters.

As a further rough test, ½ cord selected at random was measured; the total volume came out as 79·25 cu. ft., and the chip waste as 5·34 cu. ft.

Stick diam. in inches	*45° slant*		*60° slant*
	Cut half-way through from each side	*Cut wholly from one side*	*Cut half-way through from each side*
	Percentage of total cu. volume of stick lost in chips		
2	1·75	4·25	3·05
4	3·50	8·25	6·10
6	5·33	12·50	9·15
8	7·00	16·75	12·40
10	8·75	20·75	15·30
12	10·50	25·00	18·40
14	12·40	29·00	21·40

32.8. *Grading and Storage of Wood in the Rough*

32.82 : 31.42.12 : 33.36.1 : 12.25. BUTOVITSCH, V., and NENZELL, G. Sommarlagring i skogen av helbarkat timmer. **[Summer storage of completely barked timber in the forest.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (49–67). [Sw.] [1249.]

A detailed report is made on continued experiments [cf. *For. Abstr.* 1 (278); 5 (259)] on the storage of timber that has to be left in the woods until the next extraction season, with special reference to the protection of completely barked timber from blue-stain and splitting. (i) Pine and Spruce logs were treated in April 1942 with 1-per-cent. Pulpasan solution, stacked direct on the ground, the uppermost layer filled in with pulpwood and covered with a thick turf layer, and the ends of the stack protected with a dense wall of slash. At the end of October the greatest blue-stain had occurred in a pure Pine stack, the least in a pure Spruce stack, and an intermediate degree in a mixed stack. The top and especially the bottom layers of logs showed considerable stain, but the middle layers were well protected, and in all layers staining at the ends of the logs was of no practical importance. No significant splitting occurred. (ii) Tarred paper was used to cover Pine and Spruce logs sprayed in June 1942 with 1-per-cent. Pulpasan. In late October only the underside of the bottom logs showed any considerable blue-stain. End staining was inconsiderable. Splits could not be assessed as splitting had occurred before the logs were treated. (iii) Pine logs sprayed in mid-April 1943 with different concentrations of pentachlorphenol, Fibrosan, and Lignasan, were stacked in a single layer on large barked pulpwood as a foundation, and covered first with fresh Spruce slash and a month later with moss turves to a depth of 20–30 cm. Examination in early December showed that pentachlorphenol had insufficient preservative effort, but 2-per-cent. solutions of Fibrosan and Lignasan were highly effective in spite of the unfavourable stacking conditions. (iv) Pine logs were sprayed in mid-June with 1-per-cent. Fibrosan with or without the addition of Spridex, a spreading and wetting agent, and Lignasan at the same concentration. Stacks were built on a foundation of pulpwood, which was also used as a first covering, the final covering being of thick moss turves on all sides. By mid-October no blue-stain of practical importance had developed in any layer. Lignasan and Fibrosan were about equally effective, and the addition of Spridex somewhat improved the effectiveness of the latter. (v) A longer trial, from early May, 1943 to early June, 1944, in which Pine and Spruce logs were treated with 1-per-cent. Lignasan, stacked direct on the ground and covered with slash and turves, showed that whereas the Spruce was practically free from blue-stain in any layer, Pine was considerably stained except in the bottom layer. For both species, end stain was greater at the butt than at the top. A sawing test agreed well with the field sampling results. (vi) Results for the period 1938–43 suggest that the cost of summer storage of barked timber would average 5–6 öre per cu. ft., made up as follows:—chemicals 1·0, preparation of solution and spraying 0·5, stacking 1·5, and moss or turf covering 2·5 öre per cu. ft. If tarred paper should prove as effective a covering as it promises to be, its use should reduce the cost by more than half.

Pulpasan and Fibrosan are Swedish preparations containing mercury salts.

32.9. *Transport*

32.9 : 07.7. GODWIN, G. **A new machine for log transport.** Canadian Pulp and Paper Association, 3420 University Street, Montreal. *Woodlands Section Index* No. 798 (B–8–d), 1945. pp. 2. [1250].

A preliminary report on a new type of logging machine which is undergoing field tests. The machine consists of a tilting trailer, and 18-ft. platform which carries two arches supporting a monorail. A double-sheave travelling block is free to travel the length of the monorail. The tractor mounts a standard winch which operates the mainline and a secondary winch operating the unloading line. Time studies on field tests so far conducted indicate that the machine, hauled by a 35–55 h.p. tractor, will increase long-log pulpwood production by one-third. The machine as built is provided with an 18-ft. platform to handle 25-ft. pulpwood logs. To handle 16-ft. sawlogs, a 12-ft. platform would be adequate.

32.91.22 : 07.7. NYLINDER, P. Virkes-transporter med fyrhjulsdriven lastbil. **[Timber transport by means of lorries with 4-wheel**

drive.] *Svenska SkogsvFören. Tidskr.* 43, 1945 (392–408). [Sw.] [1251].

The lorry described is a 6-cylinder, 105-h.p., petrol-driven Volvo T L V 141, designed in the first place for military use. Preliminary results with a two-axled trailer were good but petrol consumption was high, as was also the cost of the trailer. Trials with a one-axled trailer, giving a full load of 8·7 metric tons, showed that the equipment was satisfactory for light and moderately difficult cross-country work. Costs are calculated and it is estimated that on simple, rough forest roads the economic limit between lorry transport of this type and horse transport with a pneumatic-tyred waggon lies at about 3·7 km. The best conditions for the use of lorries with 4-wheel drive exist when a relatively good network of forest roads is supplemented by cheap, rough roads. Under such conditions wood can be skidded direct to the lorry and re-loading reduced to a minimum. On reaching a sufficiently good road, the 2-wheel drive can be used and the vehicle will thus serve for transport from the forest direct to destination.

32.91.22 : 82. HUMMELBERGER, L. Leistungssteigerung beim Handschlittenzug in den Gebirgsforsten. **[Increasing efficiency in hand-sledge transport in mountain forests.]** *Forstarchiv* 20, 1944 (152–6). [G.] [1252].

War-time timber requirements in Germany necessitated the exploitation of much mountain forest, where the question of transport was of the first importance. No mechanical equipment was available beyond a few motor-driven cable railways, and the only alternative was hand sledging by a few old forest workers past their prime, and prisoners of war and foreign labour unaccustomed to the work. The writer enumerates the necessary measures for improving efficiency in this type of transport. The most important factor is that the timber, which is mostly felled in the summer, should be properly prepared for transport, i.e. roughly sorted into size classes, the smaller wood stacked, and the big logs assembled beside the main sledging track before the first snowfall. Secondly, the best possible equipment, sledges, tools and roads, should be provided and kept in constant readiness for use. Much experiment is going on to evolve the most satisfactory design of sledge for mountain use. The following are the dimensions of those used by the author during his studies in 1943–44:—

	Long log sledge	*Cordwood sledge*
	cm.	cm.
Length of sledge . .	130–340	200–450
Breadth of sledge . .	55–130	70–115
Height of sledge . .	25–44	27–34
Width of track . .	62–90	62–90
Curved part of runners .	80–290	150–210
	kg.	kg.
Weight (sledge complete with tools).	26–95	39–112

The provision of good sledging roads and landing places, and adequate training of workmen are other essential factors in increasing efficiency.

32.92–4. TSIRULEV, A. I. Svaynȳ stanok dlya splotki breven v puchki u berega. **[Ramp on piles for tying logs in bundles at the bank.]** *Lesnaya Prom.* No. 4/5, 1944 (11–2). [Russ.] [1253].

Description, with diagrams, of a simple timber ramp and pen for bundling fuelwood logs in the water. The logs roll down the ramp and are caught on two taut cables and held until the bundle has been made up and tied, when the cables are slackened and the bundle is released for floating. The tying is done by workers on booms.

32.96 : 07.7. **A new log loader.** *W. Cst. Lumberm.* 72 (9), 1945 (62–3). [1254].

The Washington Trakloader, manufactured by the Washington Iron Works, Seattle, is operated by a Cummins diesel 200 h.p. motor with a Twin Disc Torque converter. It has a 40-ft. boom designed for heeling with single line, and one pair of tongs. Douglas Fir logs 48, 56 and 64 ft. long and scaling up to 5,000 bd. ft. are handled easily. The loading capacity of the Trakloader is estimated at 350,000 bd. ft. per day.

32.96 : 32.91.1 : 07.7 : 82. PUTNAM, M. M. **Lawrence winch for skidding and loading.** Canadian Pulp and Paper Association, 3420 University Street, Montreal. *Woodlands Section Index* No. 799 (B–8–g), 1945. pp. [2]. [1255].

An account is given of tests of a yarding and loading donkey designed by the Lawrence Manufacturing Co., Vancouver, B.C., specially suited to handle pulpwood in Eastern Canada.

The machine is designed essentially as a crane; its weight without rigging is 5,000 lb., and fully rigged on a 24-ft. sled it weighs over 12,000 lb. The power unit is a Crysler T. 120 motor assembly. The tests indicate that the basic construction and design of the donkey are sound and it is conservatively estimated that, under good topographic stand conditions, it will yard tree lengths, up to 250 ft. from the road, at a rate of 30 cords per day, with a properly trained crew of 4 men.

An intense campaign of accident prevention must be inaugurated in connexion with mechanical yarding and loading. The whole operation is extremely dangerous, and the carelessness of inexperienced men was outstanding during the tests.

33. CONVERSION AND PRESERVATION OF WOOD

33 (410) : 98 : 90. JEFFERIES, R. **The wood from the trees.** The Pilot Press, Ltd., London. 1945. pp. 143. Price 9s. 6d. [1256].

The aim of this book is to give a short review of the history, present position, and future of forestry and wood utilization; it lays particular stress on the importance which timber has assumed in the war. Chapters deal successively with the position in peace-time up to 1939, with particular reference to sources of supply for the British market; war-time problems of supply; the main chemical and non-chemical products of the living tree and new methods of utilization and processing; post-war forestry planning, particularly in Great Britain; and some possible lines of research.

33 (67.6 : 67.8) : 98.1 : 32.2. RULE, A. **East African timber production.** *Emp. For. J.* 24, 1945 (47–51). [1257].

A general account is given of the sawmilling industry in East Africa before and during the war, and its weaknesses are discussed; most important of these is the neglect of proper seasoning technique. Other points requiring attention are organization of logging (which ceases during the rains) and building-up of log stocks, survey and maintenance of logging roads, stump heights and cross-cutting lengths, log selection, study of saw-tooth types suitable for different timbers. Much more could be done to get the maximum amount of sound timber out of faulty logs, and also in the way of quarter-sawing any timber where this is advisable from the seasoning or any other point of view. Much of the man-handling of logs on to the breakdown bench could be eliminated by proper layout. Native labour is by no means cheap when related to output per head and it is necessary to organize production so as to make the best use of the labour gangs. Priority should be given to the training of selected natives as saw-doctors and sawyers.

No reliable estimate of timber supplies can be made at present, but the general impression is that East Africa can expect at best only a very modest export trade in one or two species, and that, only after very close study of overseas market requirements. The local demand for timber should, however, expand and offer considerable scope to the sawmill industry.

In hardwoods, the main commercial species are Mvule (*Chlorophora excelsa*) from Uganda and Tanganyika, and the Mahoganies (*Khaya* spp. and *Entandrophragma* spp.) mainly from Uganda. Mvule supplies are becoming scarce. Butt logs often contain 'stone', a form of calcium carbonate, which should be eliminated as far as possible in conversion and subsequent grading. It is probable that local developments in plywood manufacture will in time absorb a considerable proportion of the annual Mahogany cut. The East African Camphor (*Ocotea usambarensis*) is a very large tree both in Kenya and Tanganyika, but in existing stands overmature trees preponderate and yield a low percentage of serviceable material. Two other hardwoods of local importance are Msuheragi (*Olea hochstetteri*) and Lolliondo (*Steganthus welwitschii*). Mninga (*Pterocarpus angolensis*) occurs in savanna woodland from Tanganyika to South Africa. It is much used locally for furniture and panelling, being easy to work and of an attractive appearance. Only the difficulty of supplies limits its export possibilities.

East Africa is not well supplied with softwoods, but Podo (*Podocarpus* spp.) can be substituted for imported softwoods for many purposes. Kenya sawmills have overcome the 'blue-stain' difficulty by dipping. While not an easy timber to kiln-dry, successful results can be obtained with care and proper technique. Proper grading is needed for this species. The African Pencil Cedar (*Juniperus procera*), formerly much used in building construction, is

now mainly utilized for pencil slats and roofing shingles. Here, again, the sawmiller will have to grade his products and, particularly for export pencil slats, might well start by more careful log selection in the forest. East Africa will in future be able to draw on areas of exotic conifers. The rapid and satisfactory growth of Cypress (*Cupressus* spp.) in parts of Kenya, some of it milled during the war, is encouraging.

East Africa also possesses several species of 'soft-hardwoods' which were extensively used during the war, often in an unseasoned state so that they have acquired a reputation for distortion, rot, or borer attack. It is, however, possible that some may find a local market.

33 (73) : 33.15. GARRATT, G. A. **Wood in war and peace.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1460, 1944. pp. 11. P.R. [1258].

The decrease in construction-lumber utilization from 1941–44 was largely compensated for by the increased demand for boxes and crates for Services packaging. There has been a great increase in wood aircraft and naval construction during the war. The introduction of timber connectors in 1930 and the pioneer use of laminated arches in 1935 were milestones in the extension of heavy timber construction. Mention is made of the use of plywood for pre-fabricated houses, also of the use of moulded plywood, and adhesives. Resin-impregnated wood, laminated paper-base plastics and sandwich material are all briefly dealt with. Utilization is expected to increase after the war in all branches except for shipping containers, which will be replaced to a large extent by fibreboard packaging.

33 (73). WINSLOW, C. P. **Wood in the national economy.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1465, 1944. pp. 8. P.R. [1259].

For future economic utilization increased research into all potential forms of use must be made. The more successful integration of the forest products industries with stabilized, rather than migratory, industry is advocated. The sawmill, the veneer mill, fabricating works, pulping plant and chemical factory should complement one another as far as possible in every major forest area in order to realize the maximum values from timber of the species, size, quality and cost that will be available.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

33.12. Joinery, Turnery

33.12 : 07.7. HAYCOCK, A. H. **Principles of machine woodworking: trenching on the tenoner.** *Wood* 10, 1945 (224–7). [1260].

In addition to fulfilling its main functions of tenoning and scribing, the tenoner can be used for doing several other operations economically and with a minimum of trouble. Perhaps the most important of these is trenching or grooving. This article deals with the adaptation of the tenoner to this work, and methods of operation.

33.12 : 07.7. HAYCOCK, A. H. **The double-end tenoner.** *Wood* 10, 1945 (245–8). [1261].

The double-end tenoning machine saves a great deal of time in any mill where the amount of work justifies its installation. Its output is at least 4 times that of the single-end tenoner, with less effort on the part of the machinist. This article deals with the design, construction, maintenance and operation of the machine, and methods of curing the 'creeping' effect which is apt to occur in its use.

33.12 : 07.7. HAYCOCK, A. H. **Scribing on the double-end tenoner.** *Wood* 10, 1945 (281–4). [1262].

Further notes [see previous abstract] on the operation of the double-end tenoner, and some of the difficulties which may arise in its use; setting the cutters; various methods of using the machine, particularly in the manufacture of joinery. The machines can also be used as double cross-cutting saws for cutting off wide boards, etc., to dead length.

33.12 : 07.7 : 33.15.5. **Automatic fabricating process for wood.** *Sth. Lumberm.* 171 (2145), 1945 (62, 64). [1263].

An automatic process which eliminates the normal dimensional limitation of timber is announced by the Muskegon Machine Co., Inc., Newburgh, N.Y. By this process panels ranging from ½ in. to 3 in. in thickness, from 10 in. to 16 in. in length, and of almost any desired width, can be made in one piece on a single machine, using only three men per machine—two to feed untrimmed timber of any

size into the two ends of the machine, one to remove the jointed assembly from the centre. The machine used is a development of the well-known 'Linderman' machine, used for more than 25 years to eliminate waste in the lumber industry. It 'welds' wood together in such a manner that a wider piece made from two narrow pieces is at least as strong as, and frequently stronger than, a single piece of the same width. This is accomplished by the use of a double-tapered dovetail joint with one or more dovetails for the pieces, supplemented by an automatic gluing device. It locks the wood sections together so solidly that in many cases glue would not normally be required. The use of glue is to 'fuse' the wood together, the glue being forced into cells of the wood at the joint to form a 'welded' bond even stronger than solid wood. U.S. Army specifications recognize the strength properties of a section made by the Linderman method as being equal to those of a solid piece of the same size. Details are given of the machine and its operation.

33.12 : 33.15.3 : 07.7. **New method of machining laminated wood.** *Timb. Tr. J.* 175, 1945 (20–1). [Machine Tool Control, 35 Old Queen Street, Westminster, London, S.W.1.] [1264].

The increasing use now being made of improved (impregnated laminated) woods has presented a number of problems to those engaged in machining it, on account of the abrasive nature of the material. The use of carbide-tipped cutters has been developed to meet this difficulty. The article describes the way in which a woodworking firm in north-west England overcame the difficulties of machining dovetailed joints by designing a cutter constructed in two halves, the blades of which overlapped in a similar manner to those of the normal interlocking cutter used in machining metal. Further particulars may be obtained from the Controller of Jigs, Tools and Gauges, Machine Tool Control, 35 Old Queen Street, Westminster, London, S.W.1.

33.14. Match Manufacture

33.14 : 98 : 09.4. Molony, L. M. **World's match business.** *Foreign Comm. Wkly.* 20 (10), 1945 (6–8, 39–42). [U.S. Bureau of Foreign and Domestic Commerce.] I.F.B. [1265].

This article discusses the world's match industry on a geographical basis, giving figures of production, consumption, exports and imports, and the sources of raw materials used in match production. The countries dealt with are Sweden, the United Kingdom, Belgium, the Netherlands, France, Italy, Switzerland, Czechoslovakia, Germany, Norway, Poland, Lithuania, U.S.S.R., China, Japan, India, Canada, and the Central and South American Republics.

33.14 (41.5). Swords, M. **The use of home-grown timber for the manufacture of matches during the emergency.** *Irish For.* 2, 1945 (72–3). [1266].

The import of matches and match stock to Eire ceased shortly after the outbreak of war, and experiments were made with home-grown timbers, four of which (Poplar, Scots Pine, Lime and Horse Chestnut) were found to be fairly satisfactory. The first two were almost equal to imported material, if selected from the proper type of tree. Supplies of Poplar were limited and the industry had to rely almost solely on selected Scots Pine. The Pine most suitable for match manufacture is that grown on well drained, moderately fertile soil and not exposed to severe or constant wind pressure. Trees 50 to 75 years of age produce the best match stock, as the wood of older trees is liable to be brittle. Lime and Horse Chestnut were wasteful, owing to the fluted and irregularly shaped butt ends, but otherwise the quality of the wood is satisfactory for this purpose. Most of the trees had, of course, not been grown in dense stands under proper silvicultural conditions.

An account is given of the process of converting timber into match splints. The average Scots Pine in demand gives a butt-length log of 10 to 16 ft. with a mean mid-quarter-girth of 8 to 10 in. The maximum under-bark diameter of the log that the veneering machine handles is about 27 in. and the minimum diameter which would not be too wasteful to manufacture is about 9 in. The average match is very small scantling, a cu. ft. of timber containing about 96,000 match splints, but owing to the amount of waste from knots, branch whorls and other defects, only a small proportion of a log is suitable for first-class match splints.

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Wood. Laminated Materials other than Wood. Glues and Gluing

33.15.1 *Manufacture of Veneers and Laminated Wood*

33.15.1 : 31.23. BYERS, T. K. **A simple method of determining the specific gravity of veneer.** *J. For.* 43, 1945 (599–600). [Mengel Co., Louisville, Ky.] [1267].

This article describes a simple method of determining specific gravity of veneer at an aircraft factory, as a basis for rejecting light and brittle material unsuitable for use. Pieces of veneer of slightly greater area than that required by the finished sample are taken from the stock to be tested, and are oven-dried to a constant weight at 212°. On removal from the oven they are cut immediately into samples of 100 sq. cm. The thickness of each specimen is then determined to the nearest 0·001 in. by finding the average of several measurements with a micrometer, and the weight is ascertained to the nearest 0·01 gr. The specific gravity is then read directly from the appropriate table, which is based on the formula oven-dry weight (gr.) = specific gravity × oven-dry volume (cc.). A table is given for determination of specific gravity for Mahogany (*Khaya* and *Swietenia*), Yellow Poplar (*Liriodendron tulipifera*) and Birch (*Betula* spp.), for which species the method was chiefly developed. The table can, however, also be used for other species, if the thickness and specific-gravity requirements fall within its limits.

33.15.1 : 31.27 : 33.15.5. BERGIN, E. G. **Veneers and plywood: a comparison of the strength of plywoods manufactured from rotary-cut and sliced veneers.** *Proj. For. Prod. Lab. Dom. For. Serv.* No. 144, 1943. pp. 9. [1268].

This investigation was made in order to determine whether there is any great difference in strength between plywoods made from veneers manufactured by slicing and by rotary cutting respectively. Materials used were $\frac{1}{16}$-in. Yellow Birch, White Pine and Spruce and $\frac{1}{8}$-in. Yellow Birch and White Pine veneers. The results of the tests are tabulated. It was found that Spruce plywood made up with rotary-cut veneers is stronger than plywood made up with sliced veneers when bonded with Tego film glue, but that the opposite is the case when Plaskon .201–2 cold-press resin is used. White Pine plywood is stronger when made up with rotary-cut veneers than with sliced veneers. Yellow Birch plywood is stronger when made up with sliced veneers than with rotary-cut veneers.

33.15.1 : 12.25 : 33.15.5. WAKEFIELD, W. E., and BERGIN, E. G. **Red Pine plywood.** *Mimeo. For. Prod. Lab. Dom. For. Serv.* No. 104, 1944. pp. 10. [1269].

As a result of 3 investigations into the use of Red Pine veneer for plywood manufacture, the following information was obtained. Red Pine veneer can be successfully utilized with adhesives of the phenol and urea groups, of either the hot-press or cold-setting types for the production of highly water-resistant plywoods. Casein glues produce satisfactory bonds in plywood manufactured from Red Pine veneers, but lack the quality of water resistance provided by the resin glues. Cassava starch provides a satisfactory plywood where water resistance is not required. Tests have shown that slack cutting of veneers is not deleterious to the strength of the plywood as determined by the tension test parallel or at right angles to the grain of the face plies.

33.15.1 : 33.32.4. **New overlay plywood.** *W. Cst. Lumberm.* 72 (6), 1945 (76–8). [1270].

The article describes the properties and methods of manufacture of three plastic-surfaced plywood panels now being manufactured commercially, which are named respectively Super-Harborite, Inderon, and Laminex Plastic Surfaced Plywood. So far they have been available only for military use, but research is already taking place into possible future uses for them in civil life, for instance in the manufacture of railway rolling stock.

33.15.2. *Use of Plywood and other Laminated Wood*

33.15.2 : 38.2. KENNEDY, D. E. **Notes on laminated construction.** *Mimeo. For. Prod. Lab. Dom. For. Serv.* No. 100, 1943. pp. 10. [1271].

A brief summary of the work done at the Forest Products Laboratories of Canada on glued laminated construction. The subject is

discussed generally, with reference to the fundamental methods employed and problems met with in this type of construction. Some experimental work has been done to determine the strength of glued laminated beams, arches, and columns. A number of structures have been built, using laminated members of various types.

Hitherto laminated construction has been commoner in Europe than in America. But the writer believes it is destined to increase there too, owing to the diminishing supply of large timbers, and also to the fact that a stronger beam can be constructed of glued laminated timber.

33.15.2 : 33.12. **Plastics in cooperage.** *Brit. Plast. mould. Prod. Tr.* 17, 193, 1945 (264–6). L.S. [1272].

A brief illustrated description of a new type of laminated brewers' cask. The 'Merron' cask is made up of four, instead of the usual twenty or more, staves; the staves and ends are made from 16 veneers, the outer and inner of Oak and the remainder of Birch. Phenolic resin glue is used throughout. The cask was recently submitted to very severe tests, and the results were satisfactory in every way.

33.15.3. *Improved Woods*

33.15.3. Perry, T. D. **Improved wood.** *Canad. Chem. Process Ind.* 29 (1), 1945 (3–8). L.S. [1273].

An outline of some of the ways in which the properties of wood for structural and industrial application may be improved for specific uses. The three methods briefly described in this paper are: (1) combining wood layers in plywood constructions so that the grain lies in opposite directions in alternating layers; (2) combining wood layers with layers of cloth, paper, metal, plastics, rubber and the like; and (3) impregnating the wood layers with a synthetic resin, usually under pressures of 1,000 to 3,000 lb. per sq. in. In the section dealing with plywood construction, reference is made to the relative value of the two principal types of resin adhesive used in plywood manufacture: the phenol-formaldehyde adhesives (available as films in which the adhesive is in sheet form, as liquids and as powders) and the urea-formaldehyde adhesives (available in dry powder form and as liquids). In general, the phenolics are preferable to the ureas, since they possess maximum resistance to weather and water exposure. The principal types of resin-impregnated wood reviewed in the article are Tegowood, Amberwood, Compreg and Impreg.

33.15.3. **New wood treatment method.** *W. Cst. Lumberm.* 72 (7), 1945 (91). [1274].

The method described, by which wood is treated with specially prepared solutions of urea-formaldehyde resins, is particularly applicable to Hemlock and other West Coast softwoods; a pilot plant is now being established in Vancouver with a view to its commercial development. The treated wood is very hard, with generally high strength characteristics except impact strength. It is less hygroscopic than normal wood, is more fire-resistant, and is resistant to acids and alkalis. Various colour combinations can be obtained by using dyes in the treating solution. The cost of the process is considerable and requires that the treated wood be used for special purposes. Hardened Alder and Cottonwood are expected to find a use in the furniture industry, but the greatest value of the process appears to be in converting Hemlock into a hard wood of many uses.

33.15.4. *Laminated Materials other than Wood*

33.15.4 : 33.32.4. Bender, F. **Thermoplastic laminates based on kraft paper and phenolic varnishes.** Forest Products Laboratories, Dominion Forest Service, Ottawa, Canada. 1943. pp. 12. [1275].

A method for the production of resin-bonded kraft-paper laminates is described and the composition of the phenolic varnishes used for impregnation is given. The resulting sheets are brown, translucent, flexible, and tough. The specific weight of the material is 1·30. The sheets are to a certain degree thermoplastic and this property might be valuable for special applications of the material such as containers, springs, tubing, bottle caps, etc.

33.15.5. *Glues and Gluing*

33.15.5. **Synthetic-resin glues.** *Sth. Lumberm.* 171 (2144), 1945 (67–8, 70, 72, 74). [Forest Products Laboratory, Madison, Wis.] [1276].

This is one of a series of progress reports prepared by the U.S. Forest Products Laboratory. Information given is of a preliminary

nature and may be revised as further experimental results become available. Following a brief account of the types and general characteristics of synthetic glues, more detailed information is given on preparation, application, properties, etc., of phenol-resin, urea-resin, melamine-resin, and resorcinol-resin glues, thermoplastic resins and special resin glues.

33.15.5. PFENNING, H. D. **Adhesive composition for wood veneers.** *U.S. Patent* No. 2,378,244, June 12, 1945. Chem. Abstr. 39, 1945 (3696). P.R. [1277].

A high-bonding-strength adhesive that is removed easily from the heating elements in a veneer splicing machine is a mixture of a urea-HCHO powdered resin (11·0–12·0 parts by weight) with a wood-, wheat-, potato-, or rye-flour extender (0·5–2·5 parts), water (9·0–14·0 parts), and HCHO (0·4 parts). The adhesive is applied to the adjacent edges of veneers and bonded under heat and pressure.

33.15.5. **Cold-setting synthetic resin adhesives for constructional work in wood (phenolic and aminoplastic).** *Brit. Stand. Specif.* No. B.S.1204, 1945. P.R. [1278].

These specifications provide the methods of test and technical provisions necessary in purchasing specifications for adhesives based on synthetic resins, with or without additional hardeners.

The synthetic-resin adhesives covered by the first specification are manufactured and sold in three forms—liquid, powder, or film—are intended for the manufacture of flat or curved plywood, and may be used hot or cold. Plywood adhesives may be required to show resistance to water at various temperatures, and corresponding types are provided.

The cold-setting synthetic-resin adhesives covered by the second specification are manufactured and sold in the two forms—liquid or powder—and are intended for the manufacture of wooden structures or assemblies. They may be required for use when the surfaces to be joined can be brought into close contact by means of adequate pressure or, on the other hand, under conditions where close contact is impossible. An adhesive giving good service in the first case may fail in the second. The joints may be required to show resistance to hot water or only to cold water. Types are provided to cover these varying needs.

33.15.5. HEEBINK, B. G. **Some methods of gluing light laminated or plywood curved shapes from veneer.** *Mimeo. U.S. For. Prod. Lab., Madison* No. R1485, 1945. pp. 3 + plates. P.R. [1279].

A brief review of some of the methods used in gluing laminated or plywood members of single curvature, illustrated by sketches.

33.15.5 : 31.22.1 : 31.27. OLSON, W. Z. **Effect of moisture content of wood on joint strength in gluing Birch veneer and Maple lumber with room-temperature-setting and intermediate - temperature - setting phenol, resorcinol and melamine glues.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1534, 1945. pp. 4 + tbls. P.R. [1280].

This report deals with the effect of the moisture content of the wood at the time of gluing on the quality of the glue joints. Thirteen glues, representative of the phenol, resorcinol, and melamine room- and intermediate-temperature-setting types, were included in the study. The moisture content of the wood glued varied from 2 to 25 per cent. The materials used were Yellow Birch veneer $\frac{1}{16}$ in. thick, and Hard Maple blocks.

Considering both shear strength and wood failure, it appears that, with two possible exceptions, all the glues studied would be used on Birch or Maple in the moisture-content range of 6 to 21 per cent. inclusive, with reasonable assurance that, with good gluing conditions, strong joints would be obtained. The phenol glues and most of the resorcinol glues produced satisfactory joints in Birch plywood at 2-per-cent. moisture content, but the melamine glues did not in general perform satisfactorily at this moisture content. Acceptable joints were made from Birch veneer of 25-per-cent. moisture content with one of the melamine glues, all the resorcinol glues studied, and all but one of the phenol glues studied.

It is pointed out that, although strong joints were obtained on woods of rather high moisture content, it should not be inferred that such high moisture-content values are to be recommended, as there are other reasons for planning closer limits on permissible moisture contents.

33.15.5 : 31.22.1 : 31.27. LEWIS, W. C., HEEBINK, T. B., and COTTINGHAM, W. S. **Effect of increased moisture content on the shear strength at glue lines of box beams and on the glue-shear and glue-tension strengths**

of small specimens. *Mimeo. U.S. For. Prod. Lab., Madison* No. 1551, 1945. pp. 11 + figs. + plates. P.R. [1281].

The results of a few tests of box beams that were designed to fail by shear at the casein glue line between Yellow Poplar plywood webs and Sitka Spruce tension flanges, indicate that there is no great increase or decrease in glue-shear strength when the beams have a higher moisture content at test than when constructed.

Tests of small plywood-to-wood glue-tension specimens, however, indicate that an increase in moisture of about 4 per cent. above that at fabrication, produces a significant increase in the strength of the glue line in tension when casein glue is used. *From authors' summary.*

33.15.5 : 31.22.1 : 31.27. BURNETT, R. S., and MERRIFIELD, A. L. **Controlling moisture content in wood and glued test samples: inexpensive means developed for block and shear-test samples used to evaluate water-resistant glues.** *Mech. Engng., N.Y.* 67, 1945 (475–6). L.S. [1282].

A brief description of a simple but effective conditioning room which has a temperature of 80° F. and relative humidity between 31 and 33 per cent. Under these conditions wood and glued samples attained equilibrium with approximately 6·5 per cent. moisture, calculated on an oven-dry basis in three to seven days. Specified temperatures and humidity conditions for evaluating glues by Birch veneer plywood and Maple block shear tests are listed in order of length of time of test.

33.15.5 : 31.22.1 : 31.27 : 31.46. BERGIN, E. G., and WAKEFIELD, W. E. **Water resistance of casein adhesives.** *Proj. For. Prod. Lab. Dom. For. Serv.* No. 231, 1942. pp. 7 + plates. [1283].

An investigation was undertaken to determine (1) whether the formation of a jelly is an indication of the water resistance of casein glues and whether, therefore, non-jelling glues are less water-resistant than jelling adhesives; and (2) whether the 3-hour immersion period specified in R.C.A.F. specification 3V2 is sufficiently long to indicate the resistance of casein-glued joints to disintegration by water. The conclusions reached as a result of the tests, were that casein glues, whether jelling or non-jelling, stand up very well under continued immersion in water, but break down very rapidly when subjected to intermittent soaking and drying; so far as water resistance is concerned, no distinction is observable between jelling and non-jelling adhesives. The following recommendations are made for testing: that the period of soaking be extended to 5 hours; that only selected dense test slips of Maple be used; that tooling of the test piece be omitted and light hand sanding substituted; that the strength requirements of specimens tested wet shall be 1,000 lb. per sq. in. when dried at room temperature for ½ hour after removal from the water; that no fewer than 5 samples be tested for the dry joint test and 5 for the wet joint test; that in the event of failure of more than 2 out of 5 tested joints, the sample be subject to re-test; that in such re-tests 3 out of 5 samples tested must meet the strength requirements of the specification and the average of all samples re-tested must not be less than the requirements of the specification; that where wood failure exceeds 60 per cent. of the total area of the joint and the strength is less than the requirements of the specification, the test shall be ignored.

33.15.5 : 31.27. DIETZ, A. G. H., and GRINSFELDER, H. **Fatigue of urea assembly adhesives.** *Mod. Plastics* 21 (8), 1944 (119–22, 160–2 + figs. + tbls.). P.R. [1284].

Assembly adhesives, made of cold-setting urea-formaldehyde synthetic resins, are employed in the fabrication of wooden aircraft. Adhesives so used are frequently subjected to vibrating loads which induce alternating stresses in the glue. This paper presents the results of research into the failures to be expected in glue joints of this kind, particularly the nature of the failure, cycles of stress to failure at various amplitudes and stresses, and the probable fatigue limit of such an assembly. Tests were carried out at room temperature on an assembly adhesive representative of those employed in aircraft fabrication, the material used being Maple veneer at approximately 9-per-cent. moisture content. The following conclusions are tentatively drawn from the tests. A joint having the general proportions of those tested, and subjected to vibration, is as likely to fail in fatigue in the wood as in rupture in the glue line. It seems safe to say that this type of failure in glue line will occur primarily because of tension perpendicular to the glue line (and the grain of the wood) rather than by shear in the glue line. If maximum tensile stresses perpendicular to the glue lines of these adhesives are kept below 120 lb. per sq. in. there

should be no failures, and it is highly probable that stresses can be 150–160 lb. per sq. in., that is 20 per cent. of the modulus of rupture or static ultimate stresses. Application of these results depends on the ability to determine stresses in vibrating structures by analysis or test. The dimensions of overlapping parts should be large enough to keep the tensile stresses from exceeding 20 per cent. of the tensile strength of the wood perpendicular to the grain. For species such as Maple and Birch, alternating tensile stresses of 125 to 150 lb. per sq. in. may be employed; for other species, such as Spruce or Mahogany, the stresses will be less.

33.15.5 : 31.27 : 33.15.1. WAKEFIELD, W. E. **The tension normal to glue line plywood test.** Forest Products Laboratories, Dominion Forest Service, Ottawa. 1943. pp. 8. [1285].

This test was devised to give a positive and quantitative value, which can be duplicated within normal experimental error, to the adhesion between plies. It is intended to be used as a substitute for the knife test, which can be misleading when carried out by unskilled observers. Preliminary tests showed that high-quality Birch aircraft plywood had a tensile strength normal to the glue line of more than 500 lb. per sq. in. The difficulty encountered in applying a tension normal to the glue line was overcome by gluing the plywood between two specially shaped blocks of Maple (illustrated in the appendix). The glue used for this purpose was a high-grade casein capable of making joints with a strength higher than 1,000 lb. per sq. in. While it was recognized that the casein joint might fail before the bond in the plywood, it was also recognized that a plywood bond strength of 500 lb. per sq. in. was adequate, so that if failure occurred above 500 lb. per sq. in. it was immaterial whether it occurred in the casein joint, in the plywood bond, or in the body of the veneer.

Further experiment showed that the bond strength was intimately related to the character of the wood species. The relation between density and strength is not so marked in plywood as in solid wood, the factors chiefly influencing the strength of the bond being the permeability of the wood veneer to the glue, and the direction, whether tangential or radial to the annual rings, of the faces glued together. Results are given of tests on Yellow Birch, Sitka Spruce, Western White Pine, and Douglas Fir plywood. All panels tested were bonded with a phenolic film adhesive.

33.15.5 : 31.27. OLSON, W. Z., and SOPER, V. R. **Development of shear strength Maple block joints made with two resorcinol glues at temperatures from 40° to 80° F.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1486, 1945. pp.2 + tbls. P.R. [1286].

Resorcinol-formaldehyde resin glues are commonly used at temperatures of 75° F. or higher, but may be used for ship construction in shipyards where lower temperatures prevail. This investigation was undertaken to determine whether resorcinol glues would cure well enough at temperatures as low as 40° F. to give joints of sufficient strength for boat-assembly woodwork. Two commercial resorcinol resin glues were used, and the joints were made with Hard Maple blocks $\frac{3}{4} \times 2\frac{1}{2} \times 12$ in. in size. The quality of the Maple used for this experiment was such as to break in shear with a strength of at least 3,000 lb. per sq. in. Joints of this degree of strength were reached in 2 days at 80° F. and in 10 days at 70° F., but were not attained in 40 days at 60° F. or in 84 days at 40° F. It may be concluded that resorcinol resin glues of the room-temperature-setting type will not produce satisfactory joints in laminated Maple at temperatures of 60° F. or lower, and that 70° F. is so close to the borderline that 75° F. would appear to be a more conservative and safer limit for the minimum curing temperature at which to use glues of this type upon high-density woods.

Assuming that these resorcinol glues cure at the same rate on other species, it would seem possible to reach a joint strength equal to the full strength of less dense woods at temperatures lower than 70° F. This was corroborated by experiments with the same two glues on Sitka Spruce and Douglas Fir cured at 60° F., when it was found that for the particular density of wood used, the full strength of the Sitka Spruce was reached at this temperature in about 50 hours and that of the Douglas Fir in about 60 hours. There is little information yet on the durability of resorcinol-glued joints set at temperatures below 80° F.

33.15.5 : 31.27. MCLEOD, A. M., YOLTON, L. A., SANBORN, W. A., and PHILLIPS, R. S. **A comparison of shearing strength of glued**

joints at various grain directions as determined by four methods of test. *Mimeo. U.S. For. Prod. Lab., Madison* No. 1522, 1945. pp. 9 + 14. P.R. [1287].

This report covers the results of tests of the shearing strength of approximately 4,300 glued specimens in which the grain direction of one member was varied with respect to the direction of loading. In general, this member was a $\frac{1}{8}$-in. veneer incorporated in the specimen at the shearing zone. Six hardwoods and three softwoods were investigated, of which two of each classification were subjected to four methods of testing.

No definite or consistent relationship was found to exist between the four test methods considered. The effect of such factors as classification of wood, species, and method of cutting differed in their individual effect on the results obtained by each method. A consistent relationship was, however, found to exist between the shearing strengths parallel and perpendicular to the grain with those at intermediate angles. For all the species tested that were cut in accordance with Specification AN–NN–P–511b, the average values for the shearing strengths perpendicular to the grain were at least one-third of the shearing strength parallel to the grain, and the average values for the hardwoods tested were at least one-half. The shearing strength parallel to the grain may be assumed to apply without correction to glued joints when the angle of grain between members does not exceed 15°.

33.15.5 : 31.27. GABRIEL, A. E. **Experiments to develop a rapid durability test for urea-resin glues.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1533, 1945. pp. 8 + plates. P.R. [1288].

Six experiments were conducted progressively for the purpose of developing a rapid durability test for urea-resin glues. All tests were carried out on 3-ply Yellow Birch veneer selected for straightness of grain and freedom from defects, cut to $5 \times 12 \times \frac{1}{16}$ in., and conditioned to approximately 12 per cent. moisture content before gluing. The most promising method consists of continuous exposure to hot saturated air above water in an enclosed space, which leads to rapid lowering of joint strength. By varying the temperature, moisture content, and time of exposure to hot water vapour, it would seem possible to obtain any desired rate of degradation. It appears from these experiments that for testing resistance of urea-resin-glued joints to hot moist air, a temperature of 75° C. and a moisture-content value of between 25 and 30 per cent. would be desirable.

33.15.5 : 33.36.1. WANGAARD, F. F. **Summary of information on the durability of aircraft glues.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1530, 1944. pp. 13 + plates. P.R. [1289].

Methods for testing the durability of glues are reviewed, and data are given from laboratory tests involving various and changing conditions of moisture and temperature.

Phenolic resins have proved their durability under all conditions of exposure used in the tests, the strength of the glue joint being mainly limited by the resistance of the wood itself. In the case of low-temperature phenols, alkaline glues give better results than acid glues. Hot-press melamine glues appear to have similar durability to phenolic glues. All forms of urea-resin glue have generally low resistance to exposure at high humidities and ordinary temperatures, and low durability under conditions involving high temperature especially when combined with high humidity. Casein glue without preservative lacks durability under all conditions of exposure to wetting or to relative humidity above 90 per cent., but the inclusion of preservatives greatly increases durability at high humidities without apparent detrimental effects on durability in other respects. Casein shows good resistance to high temperatures. The few vinyl-ester resin glues tested showed unsatisfactory results under most conditions of severe exposure including continuous soaking, wetting-drying cycles, and high temperature when associated with moderately high humidity or moisture content.

33.15.5 : 33.15.3. EICKNER, H. W. **Durability of glue joints between blocks of compreg and of compreg and wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1536, 1945. pp. 7 + tables. P.R. [1290].

Gluing studies at the Forest Products Laboratory have shown that, with the proper glues, gluing conditions, and surface preparation, joints of high initial strength can be obtained between compreg blocks and between compreg and wood. This report gives the

preliminary results of a study on the durability of such joints when aged under controlled conditions of moisture and temperature. The materials used were two types of compreg and blocks of Sitka Spruce and Sugar Maple, and 4 types of glue, and the joints were subjected to 6 different exposure conditions and tested periodically over a period of 1 year. Similar tests are planned at the end of 2, 4 and 5 years of exposure to the same conditions. Results of the first year's tests are tabulated. It appears that the alkaline intermediate-temperature-setting phenol-resin glue and the room-temperature-setting resorcinol-resin glue joints, cured at 140° F., rank together in the position of highest durability.

33.15.5 : 31.42. CHRISTENSEN, C. M., and MOSES, C. S. **Molds and bacteria that delaminate plywood bonded with casein and soybean glues.** *For. Pathol. spec. Release U.S. Dep. Agric.* 25, 1945. pp. 12+12. P.R. [1291].

In previous work the action of bacteria has been discounted as the cause of delamination of casein-glued plywood in tests involving continuous soaking. This study was undertaken to increase the information on moulds and bacteria concerned in the break-down of protein glues as it occurs in plywood, and to determine the conditions under which the various organisms attack such materials. *Penicillium brevicaule* and *P. glaucum* made up a major part of the mould flora in casein-glued plywood. Either of them, working with the bacteria normally present in the glue and surviving in the glue line, was able rapidly to delaminate plywood shear specimens glued with any of the 5 casein glues and one soybean glue tested. A number of other common air-borne moulds were also able to digest casein glues in plywood. Exposure to the normal microflora of the air resulted in faster delamination than was produced by inoculating specimens with cultures of any of the fungi used. Of the organisms present in the glue powder, only a few kinds of bacteria survived in the liquid glues and in the glue lines of plywood made with them. Those few kinds, however, survived in considerable numbers and were able to delaminate surface-disinfected shear specimens held at a moisture content of 50–65 per cent. or soaked in water.

Sodium orthophenylphenate appears to be more effective against the bacteria than against *Penicillium brevicaule*, and sodium trichlorophenate, during the period of the test, prevented any weakening by either the mould or the bacteria. Specimens glued with casein glue, surface-disinfected, and kept in sterile, sealed jars at a moisture content of 60–65 per cent., were almost totally delaminated after 6 months, while similar specimens, autoclaved and kept under the same conditions, retained their original strength.

Data available at present do not conclusively demonstrate that purely chemical hydrolysis occurs, and experiments in which bacteria are entirely eliminated will be required to settle this question.

33.15.5 : 33.36.1. KAUFERT, F. H., and BLEW, J. O. **Experiments with preservatives for soybean glue and soybean-glued plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1447, 1944. pp. 14 + tbls. P.R. [1292].

Experiments are being carried out to collect data on the possibilities of improving resistance to moulds through the use of preservatives in soybean glues and through surface treatment of soybean-glued plywood. The authors survey in detail the work done to date and discuss the problems associated with the use of, and addition of preservatives to, soybean glues. A 15-second dip in oil solutions of effective preservatives decreased or eliminated mould on soybean-glued panels; a 5-per-cent. concentration in the glue of an oil solution of pentachlorophenol and of a copper naphthenate solution containing the equivalent of 2 per cent. copper, were equally the best surface treatments. Increased mould resistance of soybean-glue joints was obtained by adding to the glue 5 per cent. of effective chemicals, based on weight of soybean meal. Preservatives increased the viscosity of glue but did not affect the dry or wet strength or water resistance of the glue joints.

33.15.5 : 33.36.1. KAUFERT, F. H., and HUTCHINS, W. F. **Experiments on the gluing of wood treated with oil solutions of chlorophenols.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1484, 1945. pp. 6 + plates. P.R. [1293].

Yellow Birch, Sweetgum and Sitka Spruce veneer, Mahogany plywood, Sitka Spruce capstrips, and Douglas Fir and Hard Maple blocks

were treated with mineral spirits or Stoddard solvent solution of chlorophenols by a 30-second dip treatment, and the results are tabulated. Gluing was satisfactory with casein, cold-setting urea-resin, and resorcinol-resin glues, as long as the treating solution did not contain waxes or other water-repellents and sealers known to interfere with adhesion. The addition of Pine oil did not affect the gluing characteristics of surfaces treated with such solutions. Slight interference with adhesion occurred when the treating solution contained as much as 5 per cent. rosin ester gum, which indicates that the amount of such anti-blooming agents should be limited to the smallest quantity which will prevent the objectionable 'blooming' of pentachlorophenol. Light sanding before gluing improved the quality of glue joints on surfaces which were not satisfactorily glued without sanding.

33.15.5 : 33.36.2. BLACK, J. M. **The effect of fire-retardant chemicals on glues used in plywood manufacture.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1427, 1943. pp. 7 + tbls. + fig. P.R. [1294].

A study of the effects of fire-retardant chemicals on the two most widely used types of resin glues, urea-formaldehyde and phenol-formaldehyde resins; $\frac{1}{16}$-in. Yellow Birch veneer was used throughout. Details are given of the experiments carried out and the results are tabulated. Cold-setting urea resin may be used to glue veneers treated with most fire-retardant chemicals except borax. Hot-setting urea glue gave poor results with all retardants except ammonium sulphate. Results with cold-press phenolic-resin glue were poor with all chemicals and relatively poor bonds were obtained when hot-press phenolic-resin glue was used, except for veneers treated with monoammonium phosphate and ammonium sulphamate, which produced a joint of average strength. Phenolic film glue was the best for gluing fireproofed veneers, though a good joint was not obtained with veneers treated with borax and boric acid. In general, borax and boric-acid treatment caused most trouble in attempts to get a successful bond. The resistance of urea-formaldehyde and phenol-formaldehyde glues to water was in general decreased by the presence of fire-retardant chemicals.

33.17. Sawmilling

33.17 : 07.7. **Remarkable new saw.** *Timb. Tr. J.* 174 (3593), 1945 (9–10). [1295].

A description is given of a demonstration of a saw designed and used at a Nottingham joinery works. It has been tested in comparison with one of the best Swedish saws. Both had a diameter of 28 in., but the Swedish saw had 88 teeth, whereas the new saw had only 64. To do identical work the Swedish saw required 16 h.p. and the other 9·5 h.p. At the demonstration the operator cut 9-in. Fir at 150 ft. per minute. This came from the saw with an excellent finish. The speed was then increased to 236 ft. per minute, which meant that the 10 ft. deal was cut in 2½ seconds using a 30-h.p. motor. At the same high speed the saw deep-cut Oak, Mahogany, Walnut, Sycamore, Chestnut, Elm, Teak, Magnolia and Ash, all with excellent results. The cutting produced a wrought surface and a knife edge and similar effects were obtained in cutting laminated boards. The same set is used for both hardwoods and softwoods, the former being cut at 13,000 r.p.m., and the latter at 11,000 r.p.m. Time spent on sharpening, setting and gulleting, and expenditure of electrical power are both reduced by 50 per cent., and the cutting finish is greatly improved. So far as is known, the cutting speed of 236 ft. per second has never before been reached. In addition, it is claimed that there is an increased mechanical efficiency and the energy required by the machinists is reduced by one-third. The saw is to be put into production immediately by Drabble and Sanderson, Ltd., Sheffield, and is to be known as the Foyster-Drabble saw.

33.19. Other Forms of Mechanical Conversion

33.19 : 33.8. REINEKE, L. H. **Wood flour.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*565 (revised), 1945. pp. 19. P.R. [1296].

A review of the wood-flour industry in the United States, giving information on species of wood used; uses of, and variations in, wood flour; general conditions of, and probable trends in the industry; manufacture and processing; plant protection; economics of production; production and imports; and grinding and accessory equipment. Generalized wood-flour specifications are given in an appendix.

33.3. *Chemical Treatment*

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

33.32 (71). WELDON, R. L. **Pulp and paper manufacture in Canada—past and future.** *Pulp Paper Mag. Can.* 46, 1945 (667–71, 674). [Canadian Pulp and Paper Association.] [1297].

In this general account of the Canadian pulp and paper industry, the author refers especially to (1) the position of the industry in relation to other leading manufacturing industries in the country; (2) the policy of the industry towards forest management and protection; (3) exports of and export markets for pulp and paper; (4) post-war problems of the industry.

The following are some of the points noted: (1) The amount of capital invested in the pulp and paper industry is 3½ times as large as that invested in the next leading manufacturing industry—non-ferrous metal smelting and refining. (2) At peak employment about 100,000 workers are on the pay-rolls of the industry (including labour in the woods and in power plants). (3) The industry consumes 54 per cent. of the total electric power used by all Canadian manufacturing industries, including mining. (4) Pulpwood production has risen from about 3½ million cords in 1917 to 8¾ million cords in 1943, and total pulp production from 1·6 million tons to 5·25 million tons. (5) With a mill capacity of over 4 million tons of newsprint per year, Canada exported an average of 2,810,000 tons a year during the period 1937–39.

33.32.1. *Pulp Manufacture*

33.32.1. **Sieve analysis of pulpwood chips** *Paper Tr. J.* 121 (11), 1945 (38). P.R. [1298]

A suggested method (Tappi T16 sm–45) and apparatus for measuring the amounts of several different sizes in an aggregate of dry pulpwood chips by means of sieves. It is useful for controlling various operations in the preparation of chips, such as determination when to resharpen chipper knives, and the maintenance of efficient operation of re-chippers, chip breakers and screens, thus keeping a uniformity of size distribution necessary for satisfactory digestion.

33.32.1. MCGOVERN, J. N. **Semichemical pulp.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1477, 1945. pp. 4. P.R. [1299].

Semichemical pulping can be broadly defined as a two-stage pulping process involving chemical treatment to remove part of the lignocellulose fibre-bonding material and mechanical refining to complete the pulping action. It usually refers more particularly to the process whereby wood chips are given a mild cooking with a conventional pulping agent, followed by disintegration of the softened chips in a suitable refiner. Various methods to develop a process which would give pulp with strengths approaching those of full chemical pulps but with yields near groundwood have been tried, but with limited success. There is good reason to believe that in future semichemical pulping will find increasing application because of its advantages in cost and utilization of less desirable species. Hardwoods are more suitable than softwoods for semichemical pulping. Aspen is especially suitable because of its relatively low lignin and high cellulose content. Yields of bleached pulp of 50 per cent. can be obtained, and the pulps are equal in strength to bleached softwood sulphites. Various semichemical processes are briefly described. The neutral sulphite process is generally the best suited for semichemical pulp for bleaching because its chemical action is mainly one of lignin removal with relatively little effect on cellulose and hemicellulose.

33.32.1. SEAILLES, J. C. **Treatment of cellulosic materials, wood, straw, esparto or the like for obtaining valuable industrial products.** *Belgian Patent* No. 444,422, Mar. 31, 1942. Chem. Abstr. 39, 1945 (619). P.R. [1300].

The subdivided material is cooked under pressure at higher temperatures than those used for the usual chemical treatments, in the presence of a quantity of water sufficient to keep the material completely covered during the whole treatment.

33.32.1. DREYFUS, H. **Delignification of lignocellulosic materials.** *Brit. Patent* No. 554,721, July 16, 1943. Chem. Abstr. 39, 1945 (618). P.R. [1301].

The delignification of lignocellulosic materials, e.g. wood, is accomplished by chlorinating the material at a temperature not exceeding 40°, in suspension as sawdust or similar finely divided form, in a liquid which throughout the treatment contains available Cl in a con-

centration less than 2 per cent. by weight of the liquid.

33.32.1 (54) : 31.3. AHMAD, N., and KARNIK, M. G. **A technical survey of cellulose-bearing materials of India.** *J. Coun. sci. industr. Res., India* 2, 1944 (275–90). [Indian Central Cotton Committee, Technological Laboratory, Bombay.] L.S. [1302].

The chief object of this investigation was to determine the α-cellulose content of the cellulose-bearing materials of India under the optimum conditions of Kier boiling and bleaching. The materials tested included Bamboos, grasses, straws, fibres, and the tree species Fir, Spruce, Salai (*Boswellia serrata*), Karai (*Sterculia urens*). Four processes were used—soda, sulphate, sulphite, and sodium sulphite; the last of these gave the best results. Addition of sodium aluminate as an auxiliary was found to increase the α-cellulose content of the pulp, but also increased the ash content. The Fir and Spruce samples gave good results and seem to be promising raw materials for the rayon industry. Salai and Karai did not give satisfactory results; the pulp obtained consisted of short fibres and had a low α-cellulose content. The results of the experiments on all types of materials are given in tabular form. The Bamboos include *Dendrocalamus strictus*, *Bambusa arundinacea*, and Eetta Bamboo.

33.32.1 (67.5). FRISON, E. La production éventuelle de pâtes à papier au Congo belge. [**The possible production of paper pulp in the Belgian Congo.**] *Bull. agric. Congo belge* 35, 1944 (183–204). [F.] [1303].

The writer has made microscopic studies of the wood of about 400 species found in the Congo and considers that there are about 100 which might be tested for the manufacture of paper pulp, though it appears that none of them is likely to be the equal of the northern coniferous species. A systematic list is given of the species investigated, with some indication of probable value.

33.32.1–2. PARKINSON, L. **Increased hardwood utilization through specialized treatment.** *Paper Mill News* 68 (16), 1945 (10, 12, 14–6). P.O. [1304].

The strength of paper containing high percentages of hardwood can be greatly improved by separate cooking, as stock can then be individually refined. The bursting and tensile strength can be much improved by two alternative special mechanical treatments briefly described. The use of suitable adhesives applied at the size press or in the form of internal bonding agents will also have favourable results on the strength of hardwood paper.

33.32.3. *Wallboards, Fibreboards, etc.*

33.32.3. NEWBERRY, J. R. (to Canadian Gypsum Co. Ltd.) **Hard board.** *Canad. Patent* No. 428,103, June 12, 1945. Chem. Abstr. 39, 1945 (4226). P.R. [1305].

From 1 to 10 per cent. of a partially pre-oxidized drying oil, e.g. blown soybean oil, is mixed with defibred wood and the mixture consolidated at above 400° F. under hydraulic pressure.

33.32.3 (485). NORDSHTREM [NORDSTRÖM], E. K. Proizvodstvo drevesnovoloknistykh plit v Shvetsii. [**The production of wallboards in Sweden.**] *Lesnaya Prom.* No. 1–2, 1944 (21). [Russ.] [1306].

The production of wallboards is one of the youngest branches of the timber industry in Sweden. Starting in 1929 it has expanded rapidly and by 1939 there were 11 factories with a total output of 140,000 tons annually, representing about six times the output of all types of plywood—an industry that has remained relatively unchanged for several years. This advance over the plywood industry is partly due to the qualities of wallboard and partly to the fact that 90 per cent. of Swedish plywood is made of Pine, half of which is intended for export; and, whereas the war affected all timber industries dependent on foreign markets, the manufacture of wallboard up to 1942–43 maintained its pre-war level.

A great variety of wallboards is manufactured, under trade names such as Masonite, Unit, Torex, Kramforce, etc., which can be grouped as porous, semi-hard and hard. Up to 1939–40 the two latter types predominated, but during the war demand increased for porous board for heat insulation of buildings, barracks, fire-proofing, etc., and factories are now being converted or designed primarily for the production of porous board. Hard and semi-hard boards are used for wall facings, doors, furniture, etc. From 1939 to 1944 the output of wallboard rose to 190,000 tons (not counting 3 new factories in building) and it is expected the figure will reach 220,000 by 1944; attention is given to the prospects of renewing trade with Great Britain and the Empire.

33.32.4. *Plastics*

33.32.4. SCHWARTZ, S. L., PEW, J. C., and MEYER, H. R. **Pulp-reinforced plastics are tough and strong.** *Sth. Pulp Paper J.* 8 (3), 1945 (19–22, 38–43). Also as *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1461, 1945. pp. 13 + plates. P.R. [U.S. Forest Products Laboratory, Madison, Wis.] [1307].

Strong and tough plastics were obtained by incorporating various powdered phenolic resins with high-quality paper pulp in aqueous suspension, forming the mixtures into mats, and after drying and conditioning, moulding the mats under heat and pressure to flat test panels. The ultimate tensile strength of such plastics varied from 20,000 to 25,000 lb. per sq. in., the ultimate edgewise compressive strength from 14,000 to 18,000 lb. per sq. in., and the Forest Products Laboratory flatwise toughness from 13 to 24 inch-pounds per in. of width. The properties of the best of these materials approached those of commercial aircraft-grade, cross-laminated paper plastic. So far as properties of the plastic are concerned, little variation occurred between the several grades of phenolic resin. The replacement up to 75 per cent. of the phenolic resin with soda spent-liquor lignin reduced the ultimate strength and raised the water absorption, but the product appeared promising for uses not requiring the better properties obtained with unextended phenolic resins. The pulp plastics formed with lignin, lignin in combination with a wood-resin by-product, and lignin in combination with the wood-resin by-product and phenolic resin were inferior to those formed with phenolic resin. Increasing the percentage of resin substantially increased the flow of the mats and improved the water resistance of the plastic, but caused a considerable decrease in ultimate tensile strength and toughness.

To obtain a high-strength pulp plastic it is apparently necessary that the individual pulp fibres should have high strength and that a good fibre-mat formation should exist. The fibre bonding, such as occurs in paper, is believed to have a minor rôle, for beating the pulp actually decreased the tensile properties of the resulting plastics. Groundwood pulp plastics lacked toughness but still considerably exceeded the toughness of wood-flour-filled plastic. *From authors' summaries.*

33.32.4 (76) : 12.25 : 34.6. HARDIN, R. A. **Plastics in the South.** *Sth. Pwr. Ind.* 63, 1945 (86–9). [College of Engineering, Univ. of Oklahoma.] L.S. [1308].

In considering sources of raw materials for the manufacture of plastics in the southern States, the author discusses the use of waste wood for this purpose, with particular reference to the development of a lignin plastic of good commercial possibilities, made from Yellow Pine.

33.32.4 (79.5 : 79.7). NORTON, A. J. **A preliminary report on the plastics industry as related to Pacific Northwest development.** U.S. Department of the Interior, Washington, D.C. 1944. pp. 37. [Bonneville Power Administration, Division of Industrial and Resources Development.] P.R. [1309].

33.32.4 : 12.25. BURRELL, H. (to Ellis-Foster Co.). **Activated filler.** *U.S. Patent* No. 2,380,214, July 10, 1945. Chem. Abstr. 39, 1945 (4265). P.R. [1310].

Redwood is masticated under pressure in a moist state with gentle heating to produce a wood filler for moulding compositions, having an unusually high degree of flow in hot moulding. Redwood appears to be unique in this high-flow feature.

33.32.4 : 34.6. SCHWARTZ, H. **Literature review of the utilization of lignin in plastics.** *Mimeo. For. Prod. Lab. Dom. For. Serv.* No. 101, 1944. pp. 10. [1311].

The author reviews the literature on lignin utilization, particularly that of the most recent date, in order to give some idea of the types of lignin plastics and boards which have been prepared from lignin waste materials. A list of 70 references is given.

It is concluded that a solution of the waste-lignin problem through the use of lignin in moulding powders is not very likely, because (*a*) products with better plastic properties can be prepared from other materials, and (*b*) the total tonnage of moulding powders used is very small compared with the available tonnage of waste lignin. The future of lignin in plastics would appear to lie in its use in low-priced laminated and board-type products.

33.32.4 : 34.6 : 33.39. SEIBERLICH, J. **The condensation of Scholler lignin for thermosetting plastics.** *Plastics and Resin* 4 (1), 1945 (14–6, 36). [Engineering Exp. Sta., Univ. of New Hampshire.] P.Q. [1312].

The experiment described was carried out on lignin waste from the Scholler method of saccharification, in its wet state. Samples of lignin were treated with zinc oxide or zinc sulphate and then reduced with hydrogen sulphide, with or without further treatment with formaldehyde. The resulting substances were then tested for water absorption, Masonite and wood pressed wallboard being used for purposes of comparison. The resulting data are tabulated. Lignin treated successively with zinc oxide, hydrogen sulphide and formaldehyde had a considerably lower rate of absorption during the first 3 hours' immersion than Masonite products or wallboard. This is important since products such as wallboard require low absorption during relatively short periods of immersion. The experiments are being continued.

33.34. Dyeing and Bleaching of Wood

33.34 : 12.25. Owens, K. L., and Owens, G. K. **Producing color contrasts in western Yellow Pine lumber.** *U.S. Patent* No. 2,355,553, Aug. 8, 1944. Chem. Abstr. 39, 1945 (174). P.R. [1313].

By a treatment, such as a 'vulcanizing' heat treatment, of the freshly-cut logs, followed by storage for several months, sharply contrasting streaks of light and dark colour, including brown, red-brown, grey-blue and yellow, are formed from the natural constituents of the wood. Various details and modifications of the treatment are described.

33.36. Preservation of Wood. Seasoning and Drying

33.36. Decker, G. Q. (to E. I. du Pont de Nemours and Co.). **Finishing wood surfaces.** *U.S. Patent* No. 2,363,658, Nov. 28, 1944. Chem. Abstr. 39, 1945 (3444). P.R. [1314].

Smooth, glossy, blister-free wood finishes are obtained by: (*a*) heating the wood, previously dressed and filled, at a temperature equal to or higher than that at which the subsequently applied finish will be baked; (*b*) applying the finish while the wood is essentially at the same temperature; (*c*) baking the coated wood. Thus a dressed and filled wood was heated for approximately 45 minutes at approximately 280° F. The wood, while at approximately 270° F., was primed with a composition containing Ba-base TiO_2 pigment 45·0, a urea-CH_2O-monohydric alc. resin 4·0, 45-per-cent. soybean-oil-modified glyceryl phthalate 19·0, BuOH 2·0, and hydrocarbon solvent 30·0 parts. The primed wood was baked at 270° F. for 1 hour, lightly sanded and then finished with: TiO_2 pigment 30·0, melamine-CH_2O-BuOH resin 7·0, urea-CH_2O-BuOH 11·0, 43-per-cent. dehydrated castor-oil-modified glyceryl phthalate 14·0, BuOH 18·0 and aromatic hydrocarbon solvent 20·0 parts. The enamelled wood was baked for 1 hour at 260° F.

33.36 : 31.8 : 12.26–8 : 33.19. Tippo, O. **Protective coatings for bending Oak.** *Sth. Lumberm.* 171 (2144), 1945 (36, 38, 40, 42). [Industrial Test Laboratory, U.S. Navy Yard, Philadelphia, Pa.] [1315].

The U.S. Navy has had difficulty in obtaining large quantities of satisfactory bending Oak for the production of boat frames or ribs and for other parts requiring bends of similar severity. The most important quality of bending Oak is the ability to bend and to stay bent, without splitting, breaking, crushing or buckling, and some shipyards have reported as much as 30 per cent. breakage loss. The investigation here reported was undertaken to study the effectiveness of certain side coatings in retarding surface checking and reducing wood failure in bending Oak. It was found that there is a definite relationship between the presence of surface checks and the development of bending failures, especially compression failures. Of the materials tested, aluminium paint is by far the most effective coating for the prevention of surface checking and bending failure in bending Oak.

The application of aluminium paint at the mill to all surfaces within 24 hours after cutting the timbers from the logs, followed by a second coating within 24 hours, will lead to a marked reduction in surface checking and bending failure.

33.36.1. *Preservation against Attack by Plants and Animals*

33.36.1 (489). Blichfeldt-Petersen, A. Imprægnering af Træ. **[Impregnation of wood.]** *Dansk. Skovforen. Tidsskr.* No. 9, 1945 (385–93). [Dan.] [1316].

A brief descriptive review of methods of wood preservation, and especially of vacuum impregnation with creosote. A/S R. Collstrop

uses a patented method of determining preservative retention by weighing the preservative container before and after impregnation. The full-cell process is used for timber to be protected against marine borers, and Rüping's empty-cell process for poles and sleepers. For some 15 years the Danish national railways have been using Beech sleepers impregnated with creosote (retention about 142 kg. per cu.m.); the average life of such sleepers is calculated as approximately 30 years. Beech for sleepers must be comparatively free from 'red heartwood', which, like the heartwood of Pine and Oak, is impenetrable to creosote. The minimum creosote retention necessary to preserve Pine timber against wood-rots is given as 63 kg. per cu.m. The creosote used is a standardized product.

33.36.1 : 31.43 : 13.2. FISHER, R. C. **Chemical preservation of timber.** *Repr.* from *Chem. Age, Lond.* No. 61, 1945, pp. 6. [Forest Products Research Laboratory, Princes Risborough, Bucks.] P.R. [1317].

A brief account of some of the more common wood-boring insects (pinhole borers, powder-post beetles, furniture beetles and termites) which attack seasoned and unseasoned timber, plywood and composition board, and of some of the chemical treatments (preservatives and insecticides) that are now being used in their control. Possible future developments in cheap and effective preventive and curative materials are indicated.

33.36.1 : 33.51. BOWEN, J. W. **The preservation of timber and fabrics with reference to utilisation underground.**—Author's reply to discussion. *J. chem. Soc. S. Afr.* 44, 1944 (153–4, 155–6). L.S. [1318].

The author deals with a number of questions raised in discussion of an earlier paper [cf. *For. Abstr.* 4 (239)], with particular reference to: the composition and preservative value of triolith; factors to be considered in interpreting results obtained from service tests underground; the use of non-proprietary preservatives; and fire hazard in relation to the use of timber in mines.

Preservative and fire-protection requirements for mining timbers in the Transvaal are summarized.

33.36.1 : 33.31. **Wood preservatives.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*149, 1944. pp. 12. P.R. [1319].

Data are given on the properties, uses, advantages and disadvantages of a number of materials that are used in wood preservation, and which may be grouped in the three general classes:—(1) toxic oils such as creosote and its derivatives, (2) water-soluble salts such as zinc chloride, (3) highly toxic chemicals such as pentachlorophenol in solvents other than water.

33.36.1 : 31.42.1 : 11.4. MOORE, G. E. **Soil as a culture medium for toximetric tests of wood preservatives.** *Mimeo. For. Prod. Lab., Dom. For. Serv.* No. 102, 1944. pp. 3. [1320].

The Forest Products Laboratories at Ottawa have for several years used soil as a culture medium in toximetric tests of wood preservatives. A detailed description of the technique is given. The 3 fungi used in routine tests are *Coniophora cerebella*, *Lentinus lepideus*, and *Lenzites saepiaria*, all of the brown-rot or cellulose-destroying type. The percentage loss by decay of untreated Red Pine sapwood, after 4 months' exposure to attack, seems to be independent of the species of fungus used. Whether white rots, or lignin destroyers, would show corresponding but different rates and extents of decay, or whether soil is a suitable medium for their culture, is a matter for further investigation. It is perhaps significant that the residue after 4 months' exposure of Red Pine to attack by the brown rots is only slightly higher than published values of the lignin content of Pine wood.

33.36.1 : 31.42.11. HOPKINS, C. Y., and COLDWELL, B. B. **Surface coatings for rot-proofing wood.** *Canad. Chem. Process. Ind.* 28, 1944 (849–51). P.O. [1321].

The article describes in detail a relatively rapid method for determining the effectiveness of surface coatings for rot-proofing wood. A review is first given of earlier methods. The present method is based on the use of very thin strips of wood which offer a large surface area to the action of organisms. Exposure consists of burial in moist, warm, composted earth, rich in fungi and bacteria. These conditions resemble those met with in practice, but provide acceleration of attack. Finally, the degree of decay is measured accurately by determining the breaking strength (in tension) of wood strips.

The material chosen for the tests was Yellow Birch veneer, 0·01 in. thick. Results of the tests are shown in a series of tables. The

failure of ordinary varnish sealers to prevent rotting is shown in these tests. The heavier-bodied spar varnishes afford slight protection. Properly formulated rot-proofing coatings gave a high degree of protection for the period of the test.

The permanence of rot-proofing agents, i.e. their resistance to removal by rain, heat or other conditions of exposure, is probably more important than the initial degree of toxicity, and further tests were made by the same method to determine the factor of permanence. The preliminary results of these tests are given in tabular form. Further investigation into permanence of various rot-proofing agents is being undertaken.

33.36.1 : 33.31. BLEW, J. O. **Treating wood in pentachlorophenol solutions by the cold-soaking method.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1445, 1945. pp. 8 + plate. P.R. [1322].

For this treatment it is recommended that a concentrated solution of pentachlorophenol be used and diluted with the desired solvent, the colour and grade of concentrates and solvents depending on treatment requirements. Formulae are given for determining the proper quantities of concentrate and solvent to be used in relation to the toxic concentration required.

Before treatment, the material should be well seasoned, free from bark, cut to final dimensions and all boring and framing completed.

Method of treatment and its cost and effectiveness are discussed briefly, and species of round fence posts that have been treated by this method are classified according to absorption and penetration of preservative. Various species of Pine and Red and Black Oak have given the best results.

33.36.1 : 07.7. BUCKMAN, S. J., BROWNE, R. Y., and GAY, W. H. **Non-pressure treatment of wood. III. Solvents, equipment, and methods for the treatment of wood with low viscosity oil solutions of pentachlorophenol.** *Sth. Lumberm.* 171 (2146), 1945 (35–42). [Central Laboratories, Inc., Memphis, Tenn.] [1323].

[For previous articles cf. *For. Abstr.* 4 (238), 6 (34).] The most commonly used solvents for use with pentachlorphenol in non-pressure treatment are light fuel oils. A specification is given for a tentative standard for petroleum oils for this purpose. Equipment for preparation of solutions and treatment of wood is described and illustrated. In general it is preferable to dry wood to an average moisture content of 25 per cent. or less before applying non-pressure treatment, particularly if the method used is cold soaking. Practical experience indicates that Douglas Fir, and possibly some other woods, may develop an additional resistance to treatment if dried too fast or for too long a time. Tables are given showing the absorptions and penetrations obtained by the cold-soaking process, which is best suited for the treatment of thin lumber and round pieces having a small cross section or a thin sapwood, which are in an optimum condition for treatment. The information in these tables illustrates the effect of depth of immersion on the preservative absorptions and penetrations, which is of special interest in the treatment of fence posts. A post needs the most effective treatment at the ground line, where conditions are most favourable to the development of decay. By immersing posts full length in a vertical position with the butts down, it is possible to obtain a progressively heavier absorption from the top to the butts. The hot-and-cold-bath process is the most effective of the non-pressure treatments. Data are given which support the conclusion that satisfactory penetrations and any desired absorptions up to 20 lb. per cu. ft. can be obtained in 2 × 6 in. S4S Southern Pine sapwood with a moisture content of about 20 per cent. Details are given of experiments in the value of incising patterns for increased penetration. Methods of determining absorption and penetration of preservatives are described, and a note is given on the keeping of records of treatment. Two appendices deal respectively with a method of determination of relative sludging characteristics of petroleum oil solutions of pentachlorphenol, and a plant control method of determination of pentachlorphenol in oil solutions.

33.36.1 (73) : 31.4. COLLEARY, M. J. **Treated and untreated timbers: completed service tests to date and notes regarding tests in progress.** *Mimeo. For. Prod. Lab. Dom. For. Serv.* No. 105, 1945. pp. 29. [1324].

The Dominion Forest Service Forest Products Laboratories have, for the past 11 years, been collecting records of the service life of both treated and untreated timber in a number of

structures in communication and power lines, railway structures and roadbeds, and as piling and fence posts. Out of a total of 836 recorded tests, 157 have now been completed, mostly because the structure in question has ceased to exist for one reason or another. The records obtained in these completed tests are given in tabular form, the timber being analysed according to function, species, whether treated or untreated; the average service life is further analysed according to whether it was terminated by decay, mechanical wear, a combination of the two, or other causes.

An account is given of the method by which the co-operation of officials and engineers of the timber-using organizations was obtained, and the co-operating bodies are listed. Details are given, in tabular form, of the still active tests, and the necessity of continuing and extending the series of tests is emphasized.

33.36.2. *Fireproofing*

33.36.2. LINTHICUM, J. F., GOTTSCHALK, F. W., and WAYMAN, P. **The practical aspects of fire-retardant treatment of wood.** With discussion. *Proc. Amer. Wood-Pres. Ass.* 40, 1944 (366–96). [1325].

These papers deal with miscellaneous questions such as retention of fire-retardants, specific gravity of fire-retardant solutions, glue-block shear tests, and plant-operating factors in fire-retardant treatment.

33.36.3. *Seasoning. Drying*

33.36.3 : 01.6. **List of publications on the seasoning of wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*446, 1945. pp. 22. P.R. [1326].

33.36.3 : 33.31. SMITH, F. B. (to The Dow Chemical Co.). **Wood seasoning solutions.** *U.S. Patent* No. 2,347,635, April 25, 1944. Chem. Abstr. 39, 1945 (174). P.R. [1327].

To an aqueous solution of urea is added 0·25 to 5 per cent. by weight of urea of an H_2O-soluble chlorophenolate, such as Na pentachlorophenolate, K, Ca, Ba, NH_4 or Li salt of a chlorophenol.

33.36.3. **Dry-kiln temperature schedules for aircraft lumber.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1360, (revised) 1943. pp. 2 + tbls. P.R. [1328].

A kiln-drying schedule, based on temperature control in relation to current moisture content, is given for a number of softwood and hardwood species and different thicknesses of material. The temperatures specified, which are maximum, are based on thousands of strength tests on kiln-dried material. It is pointed out that careful adherence to the schedule, together with proper regulation of relative humidity, should produce lumber equal in strength and other properties to the most carefully air-dried stock.

33.36.3. **Kiln-drying essentials for aircraft stock.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1367, (revised) 1943. pp. 4. P.R. [1329].

This publication outlines the rules to be followed in order to produce properly kiln-dried lumber. They deal with the construction and control equipment of kilns; selection of material; method of piling; instruments and temperature readings; the keeping of records; steaming; and temperatures [see preceding abstract]. Data are given on the moisture-content requirements of the stock when leaving the kiln.

33.36.3 : 31.22.2. PECK, E. C. **The seasoning of transverse tree sections.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1187, (revised) 1945. pp. 5 + plates. P.R. [1330].

Transverse tree sections tend to develop V-shaped cracks in seasoning, even though they dry without a moisture gradient from the circumference to the pith, because they tend to shrink more circumferentially than radially. The difficulty encountered in seasoning a transverse section is determined by the difference between the tangential and radial shrinkage. A table is given showing the radial and tangential shrinkage values of 37 hardwood and 28 softwood species from the green condition to a moisture content of 6 per cent., the difference between these values, and the width of the crack in a 10-in. section required to satisfy the difference. General instructions for seasoning transverse tree sections are given.

33.36.3 : 31.8. RASMUSSEN, E. F., and VOORHIES, G. **The relief of casehardening stresses in aircraft lumber.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1371, 1943. pp. 10 + figs. P.R. [1331].

A brief account is given of the progressive development of case-hardening stresses during the process of drying wood, followed by a discussion of the kiln treatment to be used in relieving such stresses.

33.37. Distillation. Manufacture of Tar

33.37 (47.0). SUMAROKOV, V. P. Khimicheskie rezervȳ promȳshlennosti sukhoy peregonki drevesinȳ v Otechestvennoy voyne. [**Chemical reserve products of the wood-distillation industry during the present war.**] *Lesnaya Prom.* No. 10/11, 1944 (9–14). [Russ.] [1332].

A general review of the numerous secondary products that have been or may be derived from the primary and waste products of the dry-distillation industry, with reference to industrial possibilities in the U.S.S.R.

33.37 : 33.38. BERTHELOT, C. **Evolution of the technique of wood carbonization and the utilization of the pyroligneous liquor.** *Génie civ.* 120, 1943 (145–7). Chem. Abstr. 39 (798). P.R. [1333].

To be profitable a plant must treat at least 40 tons of wood per 24 hours to produce 10 tons of charcoal, and find use for the pyroligneous liquor. Lack of equipment and materials prevents further development at present. The amount of acetic acid and methylene in the pyroligneous liquor depends on the cooling surface of the gas, and the temperature and quantity of water. One by-product, 'fuméol', is used as a meat preservative. 'Actigaz' is a mixture of 50–66 per cent. wood charcoal, 30–35 per cent. coal and 3–4 per cent. wood tar moulded into balls of 2 or 12 g. 'Carmogaz' is a mixture of pitch and coking coal (24–26 per cent. volatile matter) and is used in gas generators of automobiles. The wood should be dried to 8 per cent. moisture before carbonization. The furnaces for carbonization are described with drawings and the process of recovering carburants from the pyroligneous liquor is also described.

33.37. BLANC, M. P. **Distillation of wood in Glover-West vertical retorts.** *Gas J.* 246, 1945 (133–4). L.S. [1334].

Tests made at Niort in 1940 show that the carbonization of wood in Glover-West vertical retorts is practicable, and gives results interesting from the point of view of both gas and charcoal. The production per retort is from 1,000 to 1,200 cu.m. of gas (35,000 to 42,000 cu. ft.) per day at 3,200 cal. (360 B.Th.U. per cu. ft.) and about one metric ton of charcoal of good quality. Details of the process are given.

33.37 (71) : 12.25. SCHWARTZ, H., and GREAVES, C. **Production of pine tar by the destructive distillation of Canadian softwoods.** Forest Products Laboratories, Dominion Forest Service, Canada. 1944. pp. [i] + 14 + tbls. [1335].

In the experiments here described, it was established that Pine tar of a quality suitable for use in the manufacture of tyres from natural rubber can be prepared from selected resinous Douglas Fir and White Pine waste wood. On distilling selected wood on a commercial scale in a hardwood distillation plant, yields of 734 lb. and 478 lb. per cord were obtained from Douglas Fir and White Pine respectively. The resin contents of the various types of wood examined were determined and results indicate that yields of tar obtained by destructive distillation are proportional to resin contents. In the preparation of Douglas Fir tar of suitable quality for the rubber tyre industry, about 25–35 per cent. of the crude tar obtained on destructive distillation has to be distilled off in the form of low-boiling constituents which have been found, from laboratory experiments, to be useful for ore flotation. It is estimated that the 8 Douglas Fir mills in the Vancouver area would provide raw material for 220,000 gals. of crude tar, or about 155,000 gals. of refined tar, which is almost 65 per cent. of Canada's requirements in 1940. If distillation were carried out with equipment specially designed for softwood distillation, it is probable that these figures could be substantially increased. *From authors' summary.*

33.37 : 34.24 : 12.25. LEWIS, H. F., BUCHANAN, M. A., FRONMULLER, D., and KURTH, E. F. **Redwood products as inhibitors of oxidation in petroleum hydrocarbons.** *Industr. Engng. Chem.* (*Industr. Ed.*) 37, 1945 (988–90). P.R. [1336].

In this investigation, inhibiting power was determined for tannin from Redwood (*Sequoia sempervirens*) and for derivatives resulting from the destructive distillation of the tannin fraction and the Redwood itself. Purified Redwood tannin appears to be the most effective of the Redwood products tested: 0·001 per cent. of a tannin prepared by extracting Redwood with warm water, followed by solution of the active tannin fraction in ethyl acetate, shows an induction period of almost 11 hours; the same amount of benzyl-p-aminophenol has an induction of about 7 hours. The phenolic fraction

of the tar prepared by the destructive distillation of Redwood phlobaphene at reduced pressure has an induction period of 18 hours at a concentration of 0·01 per cent. The induction period of catechol at the same concentration is 13 hours. Crude Redwood tar from the destructive distillation of Redwood rootwood at a concentration of 0·01 per cent. has an induction period of 16 hours. The crude tar from stumpwood has an induction period of 11 hours. These tars differ in composition from similar products obtained by the destructive distillation of hardwoods. *Authors' summary.*

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

33.38.1 : 33.37. Risi, J. La fabrication du charbon de bois: renseignements pratiques pour les charbonniers. [**Manufacture of charcoal: practical instructions for charcoal-burners.**] *Bull. Minist. Terres For. Québec* No. 8 (*n.s.*), 1945. pp. 44. [F.] [1337].

The subjects treated in this pamphlet include the nature and properties of charcoal, the construction of kilns, the process of manufacture and the packing and storage of the finished product. The kilns described are of brick, stone or concrete and provide facilities for the partial recovery of tars.

33.38.2 (71.4). Risi, J., Brûlé, M., and Picard, M. Étude de quelques propriétés des charbons de bois du Québec se rapportant à leur utilisation comme carburant dans les gazogènes. [**Study of some properties of Quebec charcoals with reference to their use as producer-gas fuel.**] *Bull. Minist. Terres For. Québec* No. 6 (*n.s.*), 1945. pp. 30. [F.f.] [1338].

The species studied in this investigation were *Thuja occidentalis, Pinus strobus, Abies balsamea, Populus tremuloides, Tsuga canadensis, Picea mariana, Larix laricina, Fraxinus nigra, Salix discolor, Alnus rubra, Prunus pennsylvanica, Betula papyrifera, Ulmus americana, Betula lutea, Fagus grandifolia, Acer saccharum.* The properties of charcoal investigated were friability, hardness, cleanliness, ash content, volatile substances, tar content of volatile substances, and reactivity. The results for the various species are given in a series of tables. It was found that charcoal from coniferous species is much more friable than that from hardwoods and is therefore unsuitable for use as producer-gas fuel. The hardness of charcoals is on the whole proportional to the density of the wood. A method of measuring hardness by a combination of sieving and dropping is described, and indices of hardness are given for the species investigated. The standard specifications for ash content and humidity of producer-gas charcoal may be fixed at 3 per cent. and 8 per cent. respectively. There is apparently no relation between the volatile-substances content and the condensable-tar content, and the standard specification ought to lay down a required condensable-tar content. The sum of volatile substances expressed as percentages, and condensable tars calculated in ounces per ton ought not to exceed 40. Reactivity generally increases with the density of the wood, but also depends on the temperature of carbonization; there is a direct correlation between these factors in hardwoods, and an inverse relation in softwoods.

On account of the interdependence of almost all the physical and chemical properties of charcoal, the authors propose the introduction of the term 'densicalories'. The apparent density multiplied by the heat of combustion expressed in calories should give a minimum of 3,000 for a good producer-gas charcoal. Only the densest woods (*Betula lutea, Fagus grandifolia, Acer saccharum, Ulmus americana*) provide charcoal suitable for the purpose, and they should be carbonized at the highest possible temperature.

33.38.2 (71.4). Risi, J., and Deschênes, M. Étude du mécanisme de carbonisation de quelques espèces de bois de la province de Québec. [**Study of the mechanism of carbonization in certain species of wood in the Province of Quebec.**] *Bull. Minist. Terres For. Québec* No. 7 (*n.s.*), 1945. pp. 35. [F.] [1339].

This is the last of a series of publications dealing with charcoal and its utilization as gas-producer fuel [cf. *For. Abstr.* 5 (49), 7 (No. 1338)]. The present study deals with the general phenomena of carbonization. The conclusions reached are as follows. Wood which shrinks considerably during carbonization forms the best gas-producer fuel. Softwoods indigenous to Quebec have a tendency to swell and are therefore unsuitable. Data are presented and discussed on tests in the course of which 3,500

pieces of wood of different species and forms were carbonized at different moisture contents, and under different conditions of time and temperature. The influence of the form and moisture content of the wood is not noticeable at 250° C. but at temperatures above 300° C. any increase in the mass of the wood and its moisture content considerably retards carbonization. The following comparison is made in the more important properties of softwoods and hardwoods. The hardwoods carbonize more quickly and within wider limits of time and temperature than the softwoods. The hardwoods are characterized by considerable shrinkage in the course of carbonization, while the softwoods are remarkable for a more or less pronounced swelling. The hardwoods are less susceptible to damage from sudden and rapid rises of temperature in the gas producer. Hardwood charcoals are harder than softwood ones and have the advantage of breaking into small, clean fragments under the action of pressure or heat, while softwood charcoals tend to form excessive quantities of dust without breaking into pieces. All these qualities are to the advantage of hardwoods. The following list of native species is given in descending order of value as producer-gas fuel; it is roughly in direct relation to the density of the respective woods. Excellent producer-gas fuels: Maple, Beech, Cherry, Elm; good: Ash, Plane; mediocre: Birch, Aspen; bad: all coniferous species.

33.39. Manufacture of Sugar and Alcohol from Wood

33.39 : 34.6. Boinot, F. C. (vested in the Alien Property Custodian). **Saccharifying cellulosic materials such as wood chips or sawdust with diluted inorganic acids.** *U.S. Patent* No. 2,356,500, Aug. 22, 1944. Chem. Abstr. 39, 1945 (191). P.R. [1340].

A method of operation is employed for gradually saccharifying cellulosic material, which involves passing the material successively through a plurality of separate cooking zones and de-sugaring zones in alternate sequence, each successive cooking zone being maintained at a higher temperature, the material being cooked in each cooking zone for a predetermined time with a dilute aqueous inorganic acid, such as a 0·5-per-cent. aqueous HCl solution, for the production of sugar, and subjected to exhaustive diffusion with an aqueous liquid of lower acid content than the cooking solution for removing the whole amount of sugar from the material and saturating it with acid for the next cooking step, so that each successive cooking step is effected with a weaker acid solution than the previous step. An arrangement of apparatus is described.

33.39 (75.7) : 34.6 : 98.1. Lotti, T. **Wood waste available for conversion to ethyl alcohol in the Columbia area of South Carolina.** *For. Surv. Release Appal. For. Exp. Sta.* No. 17, 1944. pp. 14 + plate. P.R. [1341].

About 332,000 tons (oven-dry) of Pine wood waste, including slabs, edgings, and sawdust from sawmills, and sawdust and shavings from concentration yards, are produced annually in the Columbia area of S. Carolina. Of this amount there is an unused surplus of about 188,000 tons which, if utilized for the manufacture of alcohol, would yield 9 million gallons. This bulletin analyses the sources of supply and the cost of transport to a centrally located alcohol plant. With some possible reduction in rail rates it is estimated that the cost of transporting wood waste to the plant would amount to $ 1.40 per ton (oven-dry), which is the equivalent of 2.8 cents per gallon.

The concentration yards and sawmills of the Columbia area draw their Pine timber from about 20 of the 46 counties in the State. In 1936 these counties contained about 6·6 billion bd. ft. of Pine sawtimber. In the 7-year period from 1 Jan. 1936 to 1 Jan. 1943, this Pine stand has increased to about 6·8 billion ft., a net increase of nearly 4 per cent.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

33.52 (66.7) : 33.36.1. Gold Coast. **Report on the Forestry Department for the year 1944–45.** Govt. Printing Department, Accra. 1945. pp. 7. [1342].

The 90 creosoted sleepers laid in the railway tracks in 1940 showed little change from the condition recorded in last year's report. The records so far show Kusia (*Sarcocephalus diderrichii*) to be very resistant to insect and fungoid attack and to deterioration due to atmospheric conditions (p. 2).

33.52 (67.5) : 33.36.1. Staner, P. Bois congolais pour traverses de chemin de fer. **[Congo**

woods for railway sleepers.] *Bull. agric. Congo belge* 32, 1941 (322–52). [F.] [1343].

Notes on 68 indigenous tree species used in the Congo and neighbouring countries for the manufacture of railway sleepers. The information includes vernacular names, location, wood characteristics, and where used for railway sleepers. Sleepers are usually treated with either creosote or arsenic. A 48-hour immersion in a 1-per-cent. solution of arsenic is said to give complete protection for at least 9 years.

33.53 (79.5) : 12.25 : 33.36. GRANTHAM, J. B. **The production of poles from Lodgepole Pine in Oregon.** *W. Cst. Lumberm.* 72 (9), 1945 (99–100, 102, 104). [Oregon State College, Corvallis, Ore.] [1344].

Since the Lodgepole Pine (*Pinus contorta* var. *murrayana*) stands of eastern Oregon have been generally regarded as non-commercial forests, little detailed information on them is available. This article suggests methods for estimating available pole stock. The following general assumptions were arrived at from field observations. (1) A tree 8 in. d.b.h. is the smallest size which offers a possibility of profitable pole production. (2) On an average, Lodgepole Pine will produce a pole length equivalent to 55 per cent. of its total height. (3) At a conservative estimate, $\frac{1}{3}$–$\frac{1}{2}$ of all Lodgepole Pine over 8 in. d.b.h. is suitable for poles. Tables are given of pole values for Lodgepole Pine in Eastern Oregon and estimated yield of poles per acre for well stocked Lodgepole Pine stands of different average diameters. A comparison is made of the qualities of Lodgepole Pine, Douglas Fir and Western Red Cedar for this purpose. Preservatives, particularly the chlorophenols, which can be applied by non-pressure processes, offer promise of a simple, effective, and relatively inexpensive treatment of Lodgepole Pine poles, which may help to offset the high cost of shipping the poles to established treating plants. The heartwood of Lodgepole Pine is known to be easier to treat with preservatives than that of the other two species, and it is important that the relative penetrability of the sapwood of the 3 species should be determined.

33.6. *Packing Boxes, Crates, etc.*

33.6 : 33.15.2. LIMAYE, V. D. **The testing of Indian plywood tea chests.** *Indian For. Rec. n.s* (*Utilization*) 3 (4), 1945. pp. 10 + plates. [Forest Research Institute, Dehra Dun, U.P.] P.R. [1345].

Nine different types of plywood tea chests made chiefly of Hollock (*Terminalia myriocarpa*) wood, were subjected to systematic strength tests with a view to establishing a standard tea chest of Indian make which should be comparable with the best foreign makes. Two of the types tested were found to be very much stronger than the average of the five best makes of imported Birch tea chests. By reducing the thickness of plywood to $\frac{3}{16}$ in. it has been found possible to reduce the cost of the tea chest without sacrifice of the required strength. On the basis of results obtained in the tests, one type of chest and an alternative are recommended as standard for Indian production.

33.8. *Other Manufactured Products*

33.8. **Wood in the construction of motor torpedo boats.** *Wood* 10, 1945 (240–2). [1346].

Boats of this type are just over 71 ft. in length and 20 ft. in beam. The frames and transom are first installed in the stocks, and the laminated keel and stern are then lowered into position. The sides are next fitted, which consist of a double skin of diagonally placed Mahogany planking, with aero fabric treated with a bitumastic composition interposed between the two skins. The deck is of plywood. The boats are driven by 3 Packard supercharged engines of 1,350 h.p. each, and the armament includes one six-pounder power turret forward, one twin Oerlikon aft, two twin ·303 machine guns, two 18-in. torpedoes, and one rocket illuminant projector. From these details it is possible to form some idea of the strain to which the wood structure is liable.

33.8 : 33.12 : 33.15. WAKEFIELD, W. E. **Cellular wooden construction.** *Mimeo. For. Prod. Lab., Dom. For. Serv.* No. 103, 1944. pp. 5 + plates. [1347].

Experimental construction of light-weight wooden panels carried out at the Forest Product Laboratories of Canada has shown that it is possible to design light-weight furniture, doors, flooring, and wall panels of wood for aircraft, which are strong and robust. This type of construction has been called cellular, since the principle of reducing weight by means of the

removal of excess material or by building up cells, is fundamental to the design. While the use of stringers between boards is not new, having been used for some time in the construction of plywood-faced flush doors, the use of balanced construction in which the stringers are built in 3 plies, two parallel and one transverse to the long axis of the panel, is a new departure in construction. The advantages of such a structure are increased rigidity, less movement with moisture change, greater heat insulation, and sound-proofing. The introduction of suitable insulating materials such as asbestos fibre or rock wool in the cells will increase the heat resistance, so that the construction becomes almost fireproof. Details are given of 6 types of cellular construction, each of which has a special advantage either in choice of raw material or in its application. The use of scrap or waste plywood edging for the splines utilizes material hitherto of little value except as fuel.

33.8 : 12.26–8. **Draining boards.** *Brit. Stand.* No. 1226, 1945. pp. 8. British Standards Institution, 28 Victoria St., London. P.R. [1348].

Standard specifications for draining boards made of various materials including wood. Beech, Elm, Freijo (*Cordia goeldiana*), Iroko (*Chlorophora excelsa*), Jarrah (*Eucalyptus marginata*), Mahogany, Plane, Sycamore, Teak or Yellow Birch may be used. All timber must have a moisture content of not less than 15 per cent. and not more than 20 per cent. It must be free from all signs of decay and insect attack and the slope of grain to the working surface must be not greater than 1 in 10.

33.8. REHMAN, M. A., and ISHAQ, S. M. **Indian woods for battery separators.** *Indian For. Bull. n.s.* (*Utilization*) No. 124, 1945, pp. 11. [Forest Research Institute, Dehra Dun, U.P.] P.R. [1349].

Data on investigations and tests of various Indian woods to determine their suitability for use in the manufacture of battery separators. The batteries fitted with the separators to be tested were subjected to accelerated cycles of charge and discharge and a complete record of the specific gravity of the electrolyte, its temperature and the voltage of the cells was maintained. The cells were also tested for maintenance of charge on open circuit, internal resistance, discharge at high currents, etc. Cells fitted with Port Orford Cedar (*Chamaecyparis lawsoniana*) were used as controls. The results show that, of the Indian woods tested, *Cupressus torulosa* (Cypress) and *Michelia champaca* (Champ) were quite as good as Port Orford Cedar. *Talauma phellocarpa* was definitely unsuitable and *Adina cordifolia* could be used in batteries which would not be subjected to mechanical shocks and of which the expected life would not exceed one year.

33.8 : 12.25 : 33.3. PEAKES, L. V., jr., LLOYD, R. A., BARNES, V. S., BERRY, J. H., and RITTER, G. J. **Substitute woods for Port Orford White Cedar for storage battery separators.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1476, 1945. pp. 16 + plates. P.R. [1350].

Owing to diminishing supplies of Port Orford White Cedar (*Chamaecyparis lawsoniana*), which in the past has been practically the only wood used in the manufacture of battery separators, tests were made on separators of Douglas Fir, Noble Fir, Alaska Yellow Cedar (*C. nootkatensis*), Redwood and Bald Cypress (*Taxodium distichum*) after these had been treated with various chemical extraction solutions to improve their strength, electrical and battery performance properties. Four chemical treatments of practically equal efficiency, that were developed for Douglas Fir, gave results comparing favourably with Port Orford White Cedar except that strength properties were slightly inferior. One treatment suitable for both Douglas Fir and Port Orford White Cedar also rendered separators of Noble Fir and Alaska Yellow Cedar suitable for storage batteries. Two treatments developed for Redwood separators produced acceptable electrical and performance properties but strength properties were inferior. One treatment developed for Bald Cypress separators produced fair electrical and battery performance properties, but again strength properties were inferior. Test results are tabulated and illustrated and photographs show the apparatus used.

33.8. REHMAN, M. A., and ISHAQ, S. M. **Bending of skis.** *Indian For. Leafl.* (*Utilization*) No. 78, 1945, pp. 6 + plates. [Forest Research Institute, Dehra Dun, U.P.] P.R. [1351].

Bending tests were carried out on *Terminalia tomentosa* (Laurel), *Dalbergia sissoo* (Sissoo)

and *Artocarpus hirsutus* (Aini) for the manufacture of solid wood skis and the results of the tests are reported. A detailed description is given of the preparation of the blank, the seasoning of the wood to required moisture content, the softening of the wood before bending, operation and setting of the bend. The use of Indian timbers for ski-making, for which Ash and Hickory are used in Europe, is discussed in general.

33.8. NARAYANAMURTI, D., and RANGANATHAN, V. **Laminated skis.** *Indian For. Leafl.* (*Utilization*) No. 79, 1945, not paginated. [Forest Research Institute, Dehra Dun, U.P.] P.R. [1352].

After a brief description of the properties required and the advantages of lamination in the manufacture of skis, a method of making laminated skis from Indian timber, using water-resistant phenolic adhesive, is given. Laminated skis made of *Dalbergia sissoo* and *Artocarpus hirsutus* were found to be satisfactory in every way. Illustrations of the various stages of the process are included.

33.8 : 31.27. IZYUMSKI, P. P. Drevesina myagkikh i khvoynykh porod dlya lyzh. [**Timber of soft hardwoods and of coniferous species for skis.**] *Lesnaya Prom.* No. 10/11, 1944 (6–9). [Russ.] [1353].

The customary wood for skis is Birch, though Ash, Maple and Wych Elm (*Ulmus glabra*) are also used locally. Of the possible substitutes examined, Larch, Aspen, Elm (*U. effusa*), Lime, Pine and Willow had apparently suitable mechanical properties, the first four of these species being the best; but until large-scale tests have been made, skis of Aspen, Lime and Willow are recommended for instructional purposes only. In view of their lower resistance to abrasion, skis of Pine, Aspen, Lime and Willow should be made 25 per cent. thicker than prescribed in the standard specification for Birch, etc. This also helps to compensate for the lower density, i.e. lightness, of the possible substitutes.

With Pine or Larch the ski 'sole' must be a strictly radial section having not less than 6 annual rings per cm. Skis of Aspen, Lime, Elm, and Willow are best cut tangentially. The question of impregnation needs further study.

33.9. *Grading and Storage of Converted Timber*

33.91 : 12.25. **Grading rules for stress-graded timber.** *Brit. Stand.* No. 940, Pt. I, 1944. pp. 20. British Standards Institution, London. P.R. [1354].

These revised rules [cf. *For. Abstr.* 3 (237)] apply to (i) stress grades 1,200, 1,000, and 800 lb. f. for joists and planks (not over 4 in. × 11 in.) of European Larch (*Larix decidua*), European Redwood (*Pinus sylvestris*) and European Whitewood (*Picea abies* and *Abies alba*); (ii) stress grades 1,200 lb. c. of European Larch and European Redwood, 1,000 lb. c. of all three kinds of timber, and 900 lb. c. of European Whitewood, for use as columns or struts.

33.91 : 12.25 (71.5–6). **Grading rules for Eastern Canadian Spruce.** Maritime Lumber Bureau, Amherst, Nova Scotia. 1942. pp. 86. P.R. [1355].

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.24. Tanning Materials. Cork

34.24 : 33.32. RUSSELL, A. **Natural tanning materials of the south-eastern United States. VII. A summary of results up to the present time.** With discussion. *J. Amer. Leath. Chem. Ass.* 40, 1945 (110–21). L.S. [1356].

The survey described in this paper was begun in 1940, and some 200 species (not including the Sumacs) were collected and tested [see *For. Abstr.* 5 (129, 192–3), 6 (250)]. A description is given of the methods employed in collection and testing. Two of the more promising species, Buttonwood (*Conocarpus erecta*) and Darling Plum (*Reynosia septentrionalis*), were tested on a larger scale. In both these species, the entire tree can be chipped and made into tannin extract. Three species of Sumac (*Rhus copallina*, *R. glabra* and *R. hirta*) were tested, the leaves being used for the purpose. The preliminary tests eliminated the second and third of these, but further experiments are being made on *R. copallina*.

Tests on new stump extract of *Sequoia sempervirens* indicate that it would be suitable for use on calf upper leather but not for heavy leather. The bark of Western Hemlock (*Tsuga*

heterophylla) was found to produce leather of good quality but much darker (redder) than that produced by *T. canadensis*.

In the course of the discussion which followed the reading of the paper the points were made that the only material at present available in the U.S.A. in sufficient quantity to justify the establishment of an extract plant, is California Redwood. Dr. Russell has planted some 950 Buttonwoods in Southern Florida and they have made 18 in. limb growth and 1 in. diameter growth in one year. There are 4 million acres of similar land which might be planted. It was pointed out that tropical species seldom form pure stands in nature, and in planting such species, a mixture should be aimed at, e.g. Buttonwood and Darling Plum might be planted in alternate rows.

Studies are also being carried out on the pulping qualities of the species tested for tannin, with a view to determining possible dual-purpose species (see *For. Abstr.* 6 (101)]. Buttonwood and Darling Plum appear not to be suitable for pulp making, but the so-called Australian Pine (*Casuarina equisetifolia*) seems to have possibilities as a dual-purpose material. Its wood makes good pulp, its bark (which, however, is very thin) has a 15-per-cent. tan content, and it grows very rapidly.

34.24 (73) : 12.26–8 : 23.23 : 23.24. SIEVERS, A. F., and CLARKE, I. D. **Preliminary studies on the cultivation of American Sumac as a source of tannin.** *J. Amer. Leath. Chem. Ass.* 39, 1944 (293–319). [U.S. Bureau of Plant Industry.] L.S. [1357].

Investigations were conducted over a 3-year period at Arlington Experiment Farm, Va., to determine the practical possibilities of growing several native species of Sumac as sources of tannin. *Rhus copallina*, *R. glabra* and *R. typhina* were grown from seed and root cuttings on several soil types. The effects of harvesting the plants at certain stages once or oftener within a season, and in successive seasons, on the survival and subsequent vigour of the plants and the yield and tannin content and quality of the leaves were determined. The qualities of plants obtained from seed from several sections of the country were compared to determine the possibility of developing strains with higher tannin content.

There is a seasonal change in tannin content, which is highest at midsummer. Genetic factors also influence tannin content. All the seedlings were low in tannin except one lot of *R. copallina* grown from seed from Halifax, Virginia. There is an indication that plants grown in rich soil have a lower tannin content than plants in poor soil. The time at which a previous cutting or cuttings were made appeared to influence the percentage of tannin in subsequent growth, but there seems to be little, if any, relation between the tannin content and the total number of previous cuttings.

Stems were very low in tannin content. The highest value found was 6·9 per cent. with a purity of 27·5, in *R. copallina* grown from seed. The average of all stem samples was 3·1 per cent. *From authors' summary.*

34.24. COOKE, G. B., and SCHMIDT, C. F., Jr. **Home-grown cork.** *Mod. Packaging* 17 (8), 1944 (78–81, 142). P.O. [1358].

Data on the work already done to introduce Cork Oaks to those parts of America where it is likely they will grow. More than 100,000 Cork trees have been planted in California and the number distributed yearly has steadily increased. The cork acorns are collected in the winter and shipped to special nurseries, where they are grown in pots for one year and then transplanted to their permanent locations. The largest grove of Cork Oak in the States is in Bidwell Park at Chico, where more than 600 trees planted in 1904 are flourishing. A large nursery has recently been started at Superior. In 1941 a survey of the cork possibilities in the Southern States was undertaken and large healthy trees were located in Virginia, North Carolina, South Carolina, Georgia and Alabama, while smaller ones were found in Florida and Louisiana. A study was made of the soil, rainfall and temperature conditions of the cork-growing regions of Europe, results have been compared with the soil and climate of the United States, and a map of potential cork areas in the States has been made. In 1942 a limited number of Cork seedlings was distributed to co-operators from Maryland to Texas. The result of this initial experimental planting was encouraging and in 1943 more than 3,000 lb. of cork acorns were distributed throughout the Southern States. It is expected that, given the necessary time for trees to reach maturity, many Cork trees will soon be producing cork in the warmer sections of the States.

34.25. Christmas Trees. Medicinal Plants

34.25 : 12.25. LATTA, R. **Christmas tree quality improved by methyl bromide fumigation.** *J. econ. Ent.* 38, 1945 (398). [U.S. Bureau of Entomology and Plant Quarantine.] [1359].

Cut Fir and Spruce intended for use as Christmas trees were repeatedly fumigated with methyl bromide to determine the effect on their foliage of such fumigations, which are used under the gypsy-moth quarantine. All trees used were forest green and had been cut and piled 15 to 40 days before treatment. All fumigated trees were placed in heated rooms at about 80° F., and were kept under observation for periods of 19 to 39 days. In every instance, the fumigated trees retained their needles and colour longer than did the untreated trees. This difference was greater in the Fir than in the Spruce. It was observed that trees subjected to high dosage or long exposure to the gas were better at the end of the test than either untreated controls or trees treated with lower dosage or shorter exposure.

34.25 : 12.14.5 : 12.25 : 12.11.11. SOLODKI, F. T. Kompleksnoe ispol'zovanie khvoi s polucheniem preparatov karotina i vitamina 'C'. [**The utilization of needles for the production of preparations of carotine and vitamin C.**] *Lesnaya Prom.* No. 3, 1944 (4–6). [Russ.] [1360].

With the greatly increased demand for vitamin C and carotine, the needles of the slash at present burnt in coniferous forests may become a cheap and virtually inexhaustible source. A middle-aged Pine tree contains 1 g. carotine and 20 g. vitamin C and no great seasonal fluctuation has been observed in the vitamin content. The processing of the needles is more complicated and the yield of the vitamin preparation is lower than that of fruit.

The method of extraction used yielded a preparation with 1–3 per cent. vitamin content and a high content of other unidentified substances, but when tested on animals and in clinics this extract had no toxic or other injurious effect, and, on the contrary, was rather more effective than the chemically pure substances.

Old and new methods of extracting carotine and vitamin C, and measures for improving the taste of the preparation are briefly described.

A water-emulsion, carotine-balsamic paste has been devised which, when applied to open wounds, provides a light protective covering, decreasing pain and deodorizing the wound. Carotine in the presence of chlorophyll and balsamic substances stimulates the growth of epithelium.

Other forms of utilization of slash are described:—(1) Extraction of essential oil from Silver Fir, which is richer in vitamin than Pine. (2) Preparation of chlorophyll for use in surgery and other branches of medicine. (3) As a packing material.

34.25 : 12.26–8. DUTT, A. T. **Total alkaloids in *Alstonia scholaris*.** With comment by J. N. Rakshit. *Sci. and Cult.* 8, 1944 (555–6). L.S. [1361].

The author questions Rakshit's figures of 2·9 to 11·2 per cent. total alkaloids present in the dried bark of *Alstonia scholaris*, as he and other workers using 'standard' methods have not found more than 1·61 per cent. for the total alkaloid content of any of ten *Alstonia* species (including *A. scholaris*). He also questions the better anti-malarial properties of the total alkaloids isolated by Rakshit's method.

In commenting upon the above criticisms, J. N. Rakshit points out that two fundamental properties of vegetable alkaloids, solubility and stability, were missed by former investigators of the drug; and that consequently, attempts to support the previous results cannot be justified.

34.25 : 34.26 : 12.26–8 (54). SIDDIQUI, S., and MITRA, C. **Utilization of Nim oil and its bitter constituents (nimbidin series) in the pharmaceutical industry.** *J. Coun. sci. industr. Res., India* 4, 1945 (5–10). I.H. [1362].

The curative properties of Nim (*Melia azadirachta*, *M. indica*) have long been recognized, but recent attempts to isolate the active constituents, particularly the bitter principles (to which the therapeutic action of the oil, bark and leaves has been mainly attributed) have led to conflicting findings.

Earlier methods were too drastic to ensure the isolation of the bitter constituents in the form in which they can be presumed to occur in the plant itself. The paper describes a process for the large-scale production of nimbidin and the subsidiary bitter principles of the oil, based on the extraction of the oil with slightly diluted miscible solvents and subsequent mechanical separation of the various

constituents. The chemical composition and properties of nimbidin (the main active principal of Nim oil), nimbin, nimbinin and nimbidol are discussed, and the process of isolation of the various bitters (including nimbidinic acid) is outlined. The preparation of sodium, potassium, zinc, copper, and quinine nimbidinates is briefly described and the therapeutic uses of nimbidin and the nimbidates are indicated. Clinical trials of preparations of nimbidin have established their efficacy in the treatment of a variety of bacterial (particularly skin) affections.

34.25 : 12.26–8. STEERE, W. C. **The botanical work of the Cinchona missions in South America.** *Science* 101, 1945 (177–8). P.R. [1363].

A brief report of one of the missions investigating the sources of Cinchona in South America, undertaken in 1942–43 after the Japanese had overrun the Dutch East Indies and cut off supplies. *Cinchona pubescens* was found to occur in all the forests of the three ranges of the Columbian Andes while *C. officinalis* occurred only in the Eastern Range. Large stands of *Remigia pedunculata* were found on the western slopes of the Eastern Andes north of Bucarmaranga; although not a *Cinchona* species proper, the bark gave up to 3 per cent. quinine sulphate, with very little mixture of other alkaloids. *C. pitayensis* was discovered in the Cauca province of Central Andes, and in Ecuador at altitudes between 8,500 and 10,000 ft. where it was not previously known to exist. *C. pubescens* was also found throughout the Ecuadorian Andes. The remaining supplies in Bolivia and Peru are so inaccessible that exploitation in any quantity is almost impossible.

34.25 : 12.26–8 (86) : 12.19. STEERE, W. C. **The discovery and distribution of *Cinchona pitayensis* in Ecuador.** *Bull. Torrey bot. Cl.* 72, 1945 (464–71). [Univ. of Michigan, Ann Arbor, Mich.] O.B.D. [1364].

Although the discovery of *Cinchona pitayensis* on the Colombian/Ecuadorian frontier by Karsten in the middle of the 19th century indicated the probable occurrence of the species in Ecuador itself, no mention of this extension of range is made in any of the classic works on Ecuadorian botany which deal with the Rubiaceae. Investigations in 1943 by a Cinchona Mission revealed, however, that the species does occur at high altitudes, not only in Carchi, the northernmost province of Ecuador, but also in Imbabura Province, south of the Río Mira, and that it extends from the Río Mira south to the Río Guayllabamba, at appropriate altitudes. An indicator plant, *Cephaëlis jamesonii* Standl. appears always to be present in the same altitudinal zone.

The discovery of *Cinchona pitayensis* in Pichincha has demonstrated the ability of the species to move southward beyond two phytogeographical barriers: the deep desert valleys of Chota and Mira rivers and of the Río Guayllabamba. Further explorations have shown the species to be abundant also in the Province of León, but although the morphological characters of plants growing in this province are quite typical, the bark is not particularly rich in quinine or other alkaloids.

Cinchona trees found in Ecuador are generally smaller than those occurring in Colombia. The average trunk diameter of mature Ecuadorian trees is only 30–35 cm. The leaves are more pubescent, especially when young, and the capsules are less strongly ribbed. The trees usually grow in diffuse groups of 5–50 more or less even-aged trees on very steep slopes, in regions with a heavy rainfall and at altitudes between 2,500 and 3,230 m. The species occurs most abundantly in virgin broadleaved rain forests on the slopes of volcanoes. It does not reappear, at least for a long time, on lands that have been cut over or burned.

The alkaloid content of the Ecuadorian bark is generally not so high as that from trees growing in the northern part of the geographical range of the species in Colombia. Nevertheless, *Cinchona pitayensis* gives the highest yield of any species in Ecuador and it is especially important because of its high consistency. An additional advantage of *C. pitayensis* over the other Ecuadorian (and Colombian) species is that it produces the rare alkaloid quinidine (essential in the treatment of certain heart diseases) in small but appreciable quantities (to 1 per cent.).

There is some evidence that barks from lower altitudes are apt to be of a higher quality than barks from high altitudes, and it is suggested that experiments should be undertaken to study the quinine-sulphate content of cuttings from high-yielding clones grown at different altitudes.

34.25 : 12.26–8 (85). Pro y Castillo, L. **A new source of quinine in the Peruvian forests, *Remigia pedunculata*.** *Bol. Soc. quim. Peru* 10, 1944 (116–20). Chem. Abstr. 39, 1945 (151). P.R. [1365].

A small tree, *Remigia pedunculata*, found in the northeastern forests of Peru, has seeds rich in cupreine. Methylation of cupreine would give quinine.

34.26. Resin. Turpentine. Oils. Rubber. Latex. Gutta-Percha

34.26 (469) : 12.25. Sousa Monteiro, A. Contribuïção para o estudo quantitivo e qualitativo na gema do *Pinus pinaster* Sol. **[Contribution to the quantitative and qualitative study of the gum of *Pinus pinaster* Sol.]** *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (450–1). [Port.] E.M.B. [1366].

A comparative study of the various French and Portuguese systems of resin tapping from the point of view of resin production and the physico-chemical characteristics of the gum as observed in sample plots of *Pinus pinaster*.

34.26 : 12.25. Sinitski, V. P. Vozmozhnosti proizvodstvennoy podsochki eli. **[Possibilities of tapping Spruce.]** *Lesnaya Prom.* No. 10/11, 1944 (18–9). [Russ.] [1367].

A brief review of Russian research. That tapping of Spruce has remained in the experimental stage has been due chiefly to the liability of the incisions to fungal attack, since in contrast to that of Pine, Spruce resin exudes slowly and covers the bared surfaces less adequately. Experimental results suggest that with special methods and a short tapping period (1–2 years) this difficulty could be overcome. The methods tried have been designed to give narrow incisions with a long perimeter: they are—(1) the 'fork' method, with two vertical faces joined at the bottom in a V; (2) the 'herringbone' consisting of a vertical median channel with staggered laterals draining obliquely into it; and (3) the 'zigzag', a single zigzag channel.

Comparing methods (1) and (2) Terekhov found that the 'herringbone' yielded 28–60 per cent. more resin per unit of perimeter and was no more liable to infection than the 'fork' method. The yields decreased in the third and fourth years of tapping, probably owing to the gradual death of the wood in the spaces between the laterals.

Sinitski and Kruglikov tried variants of the 'herringbone' with 4 or 6 lateral channels on each side of the vertical, cutting the laterals simultaneously or progressively, and with incisions carried into the wood or restricted to the thickness of the bark.

Compared with controls having 4 laterals cut simultaneously, progressive fortnightly cuttings of pairs of laterals, beginning at the top, gave yields increased by 41 per cent. for 4, and 84 per cent. for 6 pairs of laterals. Incision only to the depth of the bark caused no serious drop in yield and improved resistance to fungi; no dying of the wood between the laterals was observed, and the faces healed over, so that the wound tissue had to be removed in the second tapping season.

Leskov, on the other hand, found no marked difference in yield from progressively cut laterals.

Ivinsky compared methods (2) and (3) and obtained a 95-per-cent. higher yield per unit of perimeter from the 'zigzag' than from the 'herringbone' method. Sinitski recommends for the 'herringbone' method a vertical incision 100 cm. long, 1·5 cm. wide, with 6 laterals on each side, 12–15 cm. long, at an angle of 40°, and staggered at 8-cm. intervals; all the incisions should be no deeper than the bark, and the laterals should be cut at fortnightly intervals, the first (top) pair being made at the same time as the vertical channel.

Terekhov has stated that trees of the younger age classes give lower yields and are more liable to infection of the bared faces.

34.26 : 33.37. Zelenetskaya, I. S., and Firsanova, E. N. Puskovȳe svoystva sukhoperegonnogo pechnogo skipidara. **[Properties of dry-distilled resin turpentines as motor fuel.]** *Lesnaya Prom.* No. 4/5, 1944 (21–5). [Russ.] [1368].

From an examination of 5 samples of different turpentine fractions dry-distilled from stump resin, it was concluded that even the lightest-coloured fraction, if used as motor fuel, would require preliminary heating of the mixture to 50–60° C. and was so acid that parts of the fuel system might corrode. The suitability of such turpentines as motor fuel could be increased by (*a*) distilling at as low a temperature as possible to prevent the formation of polymers and heavy resin compounds, and (*b*) not separating the fractional distillates but

subjecting all to subsequent steam distillation. Such measures should yield 92 per cent. of suitable fuel. Steam-distilled turpentine would contain less acids and would be less stable, but would still require washing with alkali.

Further studies should be made, especially of the effect of cracking the turpentines. Despite the disadvantages of the turpentines examined and their high cost, their use as motor fuel might be justified in remote districts, as local production would be simple and would demand no great outlay for equipment.

34.26 (67.5). ADRIAENS, L. Les oléagineux du Congo belge. **[The oil-producing plants of the Belgian Congo.]** *Bull. agric. Congo belge* 34, 1943 (3–110, 397–536 + plates). [F.flem.] [1369].

This study is arranged according to genera and species. The information given for each species includes scientific and vernacular names, distribution, habit, chemical composition of the species as a whole, of its oil and of its by-products. There are also lists of (1) names of plants capable of supplying edible and industrial oils; (2) names of plants which, though not necessarily suitable for production of oil, yet have a real food value; (3) oils which are of importance for the production of stearic, palmitic, oleic, linoleic acids; (4) classification of fatty substances according to their siccativity.

34.26 : 12.25 (71.4). RISI, J., and BRÛLÉ, M. Étude des huiles essentielles tirées des feuilles de quelque conifères du Québec. **[Study of essential oils extracted from the leaves of some Quebec conifers.]** *Bull. Minist. Terres For. Québec* No. 9 (*n.s.*), 1945, pp. 52 + tbl. [F.] [1370].

A report of experiments in the distillation of essential oils from the needles of *Thuja occidentalis*, *Pinus strobus*, *Abies balsamea*, *Picea mariana* and *Tsuga canadensis*. Details are given of the methods and equipment employed. The following conclusions were reached:—(1) Storage of the needles for a reasonable time, in weather which keeps them green, seems not to affect the yield. (2) Chopped twigs give a better yield than whole ones. (3) For distillation on a commercial scale, 40–50 lb. per sq. in. appears to be the optimum steam pressure. (4) Close packing of the still increases the yield. (5) Twigs from isolated trees usually give a better yield than those from trees grown in forest conditions, and young trees better than old. (6) Maximum yield is obtained in winter, from January to April; a second good period is from September to November; the yield from May to August is poor. (7) Average yields from distillation on a commercial scale for various species vary between the following limits:—

Thuja occidentalis	0·6 to 1·0 per cent.
Abies balsamea	1·0 to 1·4 „ „
Pinus strobus	0·6 to 1·0 „ „
Picea mariana	0·5 to 0·7 „ „
Tsuga canadensis	0·4 to 0·6 „ „

(8) The quality of the oil from these species in Quebec compares favourably with that from the same species elsewhere.

34.26 : 12.25. TARNUTZER, C. A., RITTSCHOF, L. A., and BORUFF, C. S. **Absorption spectra of volatile essential oils: detection of alphadicarbonyl compounds.** *Industr. Engng. Chem.* (*Anal. Ed.*) 16, 1944 (621–4). L.S. [1371].

Includes data on the chemical constants and α-dicarbonyl content of Juniper (*Juniperus communis*) berry oils.

34.26 : 12.26–8. PENFOLD, A. R., and MORRISON, F. R. **Commercial *Eucalyptus* oils.** *Bull. technol. Mus. Sydney* No. 2, 1944. pp. 36. L.S. [1372].

The first part of this bulletin treats of the species of Eucalypts which are principally used in commerce. A brief description of the species is given together with their distribution, yield of oil, principal constituents, physical and chemical constants of the respective oils. The species dealt with are *Eucalyptus polybractea*, *E. australiana*, *E. dives*, *E. elaeophora*, *E. sideroxylon*, *E. leucoxylon*, *E. cneorifolia*, *E. viridis*, *E. dumosa*, *E. phellandra* (= *amygdalina*), *E. numerosa*, *E. macarthuri*, *E. citriodora*. Tables are given showing the germicidal values of the principal oils.

The second part deals with routine laboratory methods for the examination of commercial Eucalypt oils and their principal constituents.

The future of the industry depends upon the extent to which new areas are developed, but essentially upon the conservation of the principal oil-yielding species such as *E. dives* and *E. australiana*. It has been shown that certain areas of Eucalypt country are more profitable under Eucalypts than when used for grazing;

under oil-yielding Eucalypts they return about 12*s*. 6*d*. per acre as compared with 1*s*. per acre from grazing. The Sydney Technological Museum has already established experimental plots for the propagation and cultivation of high-oil-yielding species of Eucalypts. This experimental work will also provide data on the correct planting and handling of the trees with a view to obtaining maximum growth and yield of oil.

34.26 : 12.26–8 : 34.25. Basu, N. K., and Singh, G. B. **An introductory note on the chemical investigation of the plant *Vitex negundo* (N.O. Verbenaceae).** *Sci. & Cult.* 11, 1944 (507–8). [Benares Hindu Univ., Benares.] L.S. [1373].

A pale, greenish-yellow essential oil isolated from the leaves of *Vitex negundo* showed the following characteristics: refractive index—1·475 (23°); specific gravity with reference to water at 23°—0·9215; optical rotation in a 10-per-cent. solution in chloroform—nil. From air-dried leaves of the plant the authors isolated an alkaloid which has been crystallized in the form of its tartarate (melting point 238° C.; charring 242° C.).

34.26. Hough, W. A. **Wild rubber.** *Canad. Chem. Process Ind.* 29 (1), 1945 (20–1). L.S. [1374].

Data on grades of wild rubber, methods of collection and sources of supply. Four main groups of rubber are dealt with in the article: (1) Paras (obtained largely from *Hevea brasiliensis*, *H. benthamiana* and *H. guyanensis*); (2) Centrals or Central Scrap (mainly from *Castilloa elastica*); (3) Manicobas and Mangabeiras (from *Mahihot* spp. and *Hancornia speciosa* respectively); and (4) Africans (from *Funtumia*, *Landolphia*, *Clitandra*, and African-grown *Manihot* and *Hevea brasiliensis*).

34.26. Verghese, G. T., and Kale, G. T. **Rubber yielding plants.** *Sci. & Cult.* 10, 1945 (433–41). L.S. [1375].

The main rubber-yielding plants discussed in this paper are *Hevea brasiliensis*, *Castilloa* (or *Castilla*) *elastica*, *Manihot glaziovii*, *Ficus elastica*, *Parthenium argentatum*, *Palaquium* spp., *Mimusops* spp. and *Cryptostegia grandiflora*. A 3-page appendix gives in tabular form the botanical name, natural order, trade name, and habitat of each of 162 rubber-bearing plants.

34.26 (6) : 12.26–8. Martin, G. **Wild rubber of tropical Africa.** *Rubb. Chem. Technol.* 17 (1), 1944 (240–52). *Repr.* from *Trans. Inst. Rubb. Ind.* 19 (1), 1943 (38–52). L.S. [1376].

Hundreds of different species of plants indigenous to tropical and subtropical Africa yield appreciable quantities of moderately pure rubber. Of these, the best known and most important are the tree species *Funtumia elastica* and various rubber vines of the genera *Landophia*, *Clitandra*, and *Carpodinus*. The author briefly discusses the habit and distribution of these species and describes methods of preparing the rubber. Data are given on the chemical properties of the various rubbers and on their plasticity and qualities of vulcanization.

34.26 (81 : 73). **Brazil develops new high-yield rubber tree.** *J. For.* 43, 1945 (677). [Office of Inter-American Affairs.] [1377].

Cf. *For. Abstr.* 7 (pp. 240–1).

34.26 : 12.26–8 : 12.11.22 : 12.11.16. Miron, K. F. Prizemlenie otvodkov bereskleta: sposob uvelicheniya ego guttonosnosti i vegetativnogo razmnozheniya. [**Layering of *Euonymus verrucosus* as a method of increasing its gutta production and vegetative reproduction.**] *Lesnaya Prom.* No. 10/11, 1944 (19–22). [Russ.] [1378].

Gutta-percha may be synthesized in shoots of *Euonymus verrucosus* from mobile substances at points where the accumulation of such substances is induced, e.g. by ringing, strangulation, or layering. Previous work had shown that the gutta content of layered shoots was in some, but not all, instances, considerably higher than that of normal shoots, the maximum increase being attained several seasons after the layering operation. The additional results described in this paper indicated that at the end of only one growing season the gutta content of individual layered shoots was twice that of unlayered ones.

The accumulation of gutta took place chiefly in the bark of the basal part of the shoots, the gutta content decreasing steadily with increasing height in the shoot. In tests of rooting at two different depths, the layers rooted and survived better when buried at a depth corresponding to the zone of greatest natural root development of the species for the soil in question.

Layers of various ages and diameters took root, but the increase in gutta content occurred

only in those 13 or more years old and not less than 10 mm. in diameter.

It is concluded that vegetative propagation of *E. verrucosus* by layering and root suckers would be cheaper and possibly more effective than sowing or planting, though the latter methods would remain a means of breeding high-yielding strains. Layering would serve a double purpose in that while for the smaller diameters of shoots it would be merely a means of propagation, the larger ones should be worth harvesting for their increased gutta content.

34.26 : 12.26–8 : 12.11.16. YURKEVICH, I. D. Dinamika guttonosnosti beresklеta borodavchatogo (*Evonymus verrucosus* Scop.) v zavisimosti ot vremeni goda i fenofaz razvitiya rasteniya. [**The dynamics of the gutta content of *Euonymus verrucosus* Scop. according to the season and the phenophase of the plant's development.**] *Bot. Zh. SSSR* 29, 1944 (274–81). [Russ.] O.B.D. [1379].

It is noted that, as the gutta content of *Euonymus verrucosus* increases, the percentage of resin decreases, and vice versa; in April and May when the roots contained the highest percentage of gutta, that of resin was at the lowest; in July and August the reverse was true. It is believed that, depending on seasonal changes in the plant, resin may be converted into gutta, and gutta into resin. Changes in the gutta content were in fact found to be closely connected with the seasonal development of the plant. In April, after the opening of leaf and flower buds, the content of gutta in the roots was 14·42 per cent., but as the plant developed, it gradually decreased and by August, after the ripening of the fruit, it was only 8·38 per cent.; when the plants had shed their fruit and some of the leaves, the gutta content started to increase, and by the end of November, when the growing season was over, it reached 13·99 per cent. Gutta is thus not an inactive substance in the life of a plant.

In the roots exposed for 5 years, the gutta content was much lower than in the roots of the same plant in the ground.

Harvesting of *E. verrucosus* should be done in the spring (April–May) or autumn (October–November). Exact times may vary slightly with the climatic conditions in different regions. Harvesting at the correct season should improve the yield 15–20 times.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

34.27 : 12.25 (729.2). JAMAICA. **Annual report: Forest Department for year ended March 31st, 1945.** Forest Department [Kingston], Jamaica. 1945. pp. 9. [1380].

The Department brought to the attention of local manufacturers of gin the possibility of utilizing berries of the indigenous species of Juniper (*Juniperus lucayana*). These have proved very successful, replacing imported Juniper essence (p. 8).

34.27 (91.1) : 12.26–8. MULLEN, A. J. **Brazil nuts again?** *Foreign Comm. Wkly.* 20 (13), 1945 (6–7, 47). [U.S. Bureau of Foreign and Domestic Commerce.] I.F.B. [1381].

The Brazil Nut tree (*Bertholletia excelsa*) is indigenous to the Amazon valley, and attempts to produce the nuts commercially elsewhere have been unsuccessful. The trees grow wild in scattered groups of six or more, sometimes forming small groves. They attain a height of 75 to 100 ft. and tower above the surrounding jungle. From 12 to 20 nuts are enclosed in large pods 4–6 in. in diameter. The kernels contain from 65 to 70 per cent. oil. The nuts are gathered from the ground by migratory gatherers, and are mostly exported from the ports of Belem and Manus. Exports in 1939 and 1940 were about 30,000 tons a year, but have been very small since 1941.

34.27 : 34.21. LESOUEF, D. H. **Plants poisonous to stock.** *N.Z. J. Agric.* 71, 1945 (229, 231–2). O.R.E. [1382].

Among the plants listed as poisonous to stock are the following woody species: *Juniperus sabina*, *Prunus* spp., *Ligustrum vulgare*, *Taxus baccata*, *Rhododendron* spp., *Corynocarpus laevigata*, *Cupressus macrocarpa*, *Myoporum laetum*, and *Coriaria arborea*.

34.27 : 12.26–8. CLIBBENS, D. A. **A comparative study of some properties of kapok.** *Bull. imp. Inst., Lond.* 43, 1945 (180–209). [British Cotton Industry Research Association, Shirley Institute, Manchester.] [1383].

Some of the physical properties of kapok, particularly its geometrical characters, specific volume and buoyancy, are reviewed. Before the war kapok from Java formed the greatest part of the world's supply. The cultivated kapok tree of Java is *Eriodendron anfractuosum*, known alternatively as *Ceiba pentandra*.

The Ceylon kapok of commerce is probably derived from the same species and possibly cultivated. The Indian kapok of commerce and some African kapoks, on the other hand, are from species of *Bombax*, not for the most part grown under cultivated conditions. Akund, the seed hair of a species of *Calotropis* which grows wild in parts of the tropics including India, is almost valueless as buoyant stuffing, though it is sometimes encountered under the misleading title of Brazilian kapok. After efficient machine-processing, samples of Ceylon kapok showed no intrinsic difference from prime Java kapok in buoyancy, filling capacity, or any fibre characteristics.

34.28. Bamboos

34.28 : 12.26–8 (67.6) : 2 : 12.1 : 33.36.1. WIMBUSH, S. H. **The African Alpine Bamboo.** *Emp. For. J.* 24, 1945 (33–9 + plate). [Forest Department, Kenya.] [1384].

This paper states what has been learnt from twelve years' detailed observation and from records made over a much longer period on the African Alpine Bamboo (*Arundinaria alpina*) in Kenya, where it grows gregariously over 700 square miles of montane forest between 8,000 and 10,000 ft. above sea level. A single acre holds 4,000 to 7,000 culms, of average size 45–50 ft. high and 2½ in. diameter.

The factors influencing production of new culms are discussed, and actual production figures are given for the years 1932–43. The life of a single culm is believed to be about twelve to fourteen years. Present evidence points to a life cycle of over forty years in the locality under observation. At the end of the life cycle the Bamboo flowers, seeds and dies. The flowering is gregarious, but not so far recorded as affecting more than a few hundred acres at a time. The recovery period (for normal full-sized culms again to be produced) is found to be eight or nine years after clear-cutting, or seven to eight years if 10 per cent. of the old culms are left standing at the time of cutting.

The cutting cycle (period required to produce a full normal stand after clear cutting) is found to be fourteen to twenty-one years, depending upon site. The yield from clear-cutting Bamboos is on the average forty tons air-dry Bamboo per acre. Immunity to Bamboo borers (*Dinoderus minutus* and others) is given by standing freshly cut Bamboos with all their leaves on, for twenty-four hours in a 2½-per-cent. solution of Wolman Salts or a 4-per-cent. solution of borax. *Author's summary.*

34.3. Products of the Animal Kingdom

34.3 : 13.2 : 12.26–8 : 24.51. CHHABRA, B. S. **How to grow good lac.** *Indian For.* 71, 1945 (217–20). [1385].

The object of this paper is to give in detail the ways by which lac, good in quality and quantity, can be grown in Indore State, C.I. This involves proper working of the host tree, including correct pruning, selection of brood, inoculation, cropping and control of natural enemies. Recommendations are made on orthodox lines based on the standards of the Indian Lac Research Institute.

34.6. *Utilization of Logging and Milling Waste*

34.6. **Outlets for wood waste: a general statement of actual and potential uses of various kinds of wood waste.** *Mimeo. U.S. For. Prod. Lab., Madison* No. R64, 1945. pp. 25. P.R. [1386].

A guide to the disposal of forest waste, slabs, edgings, trimmings, etc., bark, sawdust and shavings. Before utilization of wood waste whether on a large or small scale, a thorough study by experts is recommended of the conditions affecting the manufacture and sale of finished products.

34.6 (57) : 33.32 : 53. GUTERMAN, N. M. Perevodnye koefitsienty dlya drevesnykh otkhodov lesopileniya i derevoobrabotki, prednaznachaemykh dlya gidroliznoy promyshlennosti. **[Conversion factors for wood waste from sawmills and timber industries for use in the wood-hydrolysis industry.]** *Lesnaya Prom.* No. 4/5, 1944 (12–6). [Russ.] [1387].

Experiments were made to discover suitable conversion factors for determining the solid wood volume of four types of wood waste singly or in mixture. Results for the individual types are given in the accompanying table:

Depth of layer in cm.	Conversion factor				In per cent. of conversion factor for a layer 40 cm. deep			
	Sawdust from edger	Sawdust from frame saw	Shavings	Hogged chips	Sawdust from edger	Sawdust from frame saw	Shavings	Hogged chips
40	0·300	0·333	0·220	0·331	100·0	100·0	100·0	100·0
60	0·304	0·338	0·224	0·335	101·3	101·5	101·8	101·2
80	0·317	0·345	0·228	0·347	105·7	103·6	103·6	104·8
100	0·354	0·354	0·251	0·351	112·7	106·3	114·1	106·0

Conversion factors for mixtures of these materials are obtained from the formula $K_c = \frac{a_1K_1 + a_2K_2 + a_3K_3}{100\,E}$ where K_c = conversion factor for the particular mixture and depth of layer; a_1, a_2 and a_3 = weights of chips, sawdust and shavings respectively, all in percentage of the total wood waste in the mixture; K_1, K_2, and K_3 = conversion factors for each of the constituents at a given depth of layer; and E = 'settling factor' of the mixture. E was determined as varying between 0·80 and 0·82.

Notes are also included on the settling of a mixture in autoclaves in layers 9·5 m. deep.

34.6 : 12.14.8 : 12.25 : 11.47. **Redwoods and nation's gardens.** *N.S. Dak. Hort.* 18, 1945 (63). L.S. [1388].

The quantities of short, fluffy fibres and particles of thick outer bark obtained as a waste product in the utilization of *Sequoia sempervirens* have proved to be an excellent protective mulch, soil conditioner and insulator. Directions are given for the application of the material to both heavy and sandy soils. It is also recommended for use with potted plants.

34.6 : 33.8. GOODWIN, H. **Artificial wood compositions.** *Brit. Patent* No. 557,987, Dec. 14, 1943. Chem. Abstr. 39, 1945 (3648). P.R. [1389].

Street paving blocks, tiles for interior flooring and the like are made from an artificial wood composition containing sawdust, a bituminous binding agent, and an inorganic filler. The mixture of the material is subjected to pressure while at a temperature at which the binding agent is in a molten or plastic state.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.2. *Building Construction. Foundations and Superstructures*

38.2 : 31.27 : 33.91. HANRAHAN, F. J. **Structural performance of wartime wood buildings and its postwar application.** *B.C. Lumberm.* 29 (4), 1945 (92, 94, 96, 98). [1390].

Shortage of materials, labour and time have led to a considerable reduction of safety factors in timber buildings erected in the United States during the war for civilian and military use. A great many have been built on the basis of a roof load of 15 lb. per sq. ft. where building codes require 20, 30, or more pounds per sq. ft. Designs were based on the assumption that a 1,200-lb. stress-grade of timber would be used, but the design stresses for this grade were increased from 1,200 to 1,800 lb. per sq. ft. Much constructional work was done with ungraded non-structural timber as well as unseasoned timber. Investigation shows, however, that there have been very few cases of failure, and of the 7 cases of truss failure reported to the writer, 5 were of a single bad design. In general, engineers who inspected war-time timber structures have been convinced that the design stresses in use before the war for stress-grade timber were far too conservative, and therefore uneconomical, for timber buildings properly designed and constructed. In August 1943, the War Production Board issued a directive requiring an increase of 20 per cent. in working stresses for stress-grade timber and in design loads for fastenings for timber buildings. Further, specific provision was made for the use of still higher working stresses by the Army, Navy or

Maritime Commission. Pending a more exhaustive study, the U.S. Forest Products Laboratory subsequently recommended continuation of the use of the increased stresses of the W.P.B. directive for post-war building construction.

Standards for glued laminated timber are being developed under the auspices of the Central Committee on Lumber Standards, sponsored by the U.S. Department of Commerce.

38.2 : 31.22 : 31.27 (94). LANGLANDS, I. **Green timbers in Australian structures.** *Engng. News-Rec.* 135, 1945 (290–1). [Division of Forest Products, Australian Council for Scientific and Industrial Research.] [1391].

From tests on split-ring connectors, carried out by the Division of Forest Products, C.S.I.R., working loads have been obtained for green timbers (mainly *Eucalyptus* spp.) such as are used almost exclusively for timber structures in Australia, but although safe under wind and live loads and the usual combinations of wind, live and dead loads, such timbers have sometimes proved unsafe when dead loads only are acting, failure by splitting and shearing occurring some weeks or months after erection. The trouble has been most common in the high-shrinkage timbers, but it has also been found in timbers of normal shrinkage for their density. Failures are confined to tension joints, and may occur at dead loads equal to about 75–80 per cent. of the working load. The major factor in such failure, at least in green hardwoods, appears to be the effect of creep (duration of loading) associated with shrinkage stresses.

Preliminary laboratory tests on small Yellow Stringybark (*Eucalyptus muelleriana*) columns ($1 \times \frac{3}{4}$ in. cross section, 36 in. long, $\frac{1}{4}$ in. initial excentricity, 60 per cent. moisture content) showed that a load equal to 66 per cent. of the short-time ultimate load, caused failure in $6\frac{1}{2}$ days. In another case, a dense Douglas Fir specimen ($2 \times 1\frac{1}{2}$ in. cross section, 45 in. long, $\frac{1}{3}$ in. initial excentricity, 26 per cent. moisture content) loading to 80 per cent. of the short-time ultimate strength failed in 28 hours. The effect of duration of loading (creep) is therefore of considerable importance in the design of timber structures.

38.2 : 33.36.3 : 31.22.2. WOODRUFF, G. B. **Green timber for structural use.** *Engng. News-Rec.* 133 (14), 1944 (74–5). L.S. [1392].

Ninety-five per cent. of the trusses built of green timber prove entirely satisfactory, provided proper care is taken with the design, construction, and servicing of the structure in the first year after completion. With the exception of a few failures due to timber which should have been rejected as unsuitable in the first instance, the trouble with the remaining 5 per cent. of the trusses was the direct result of faulty design. Secondary causes of failures are briefly reviewed and the author points out that green timber has a greater amount of plastic deformation and gives a better chance of more uniform distribution of stress and of relieving stress resulting from deflection and imperfect fabrication than seasoned timber, and is, therefore, well suited for structural purposes, as well as being the most economical material available.

38.3. *Road and Bridge Construction*

38.3 : 02.1 (485). KINNMAN, G., and LINDFELT, B. Handledning i skogsvägbyggnad. [**Manual of forest road building.**] Svenska Skogsvårdsföreningens Förlag, Stockholm. 2nd ed. (revised), 1944. pp. 129 + pocket supplement. [Sw.] [1393].

A manual for forestry schools, etc., with chapters on: types of road; financial calculations; principles in the choice of road type; roadbuilding materials; planning of road projects; road construction; road maintenance; machines and implements; and legislation regarding roads and traffic. There are 56 text figures and a pocket supplement containing work programmes and sectional drawings for various types of roads.

38.3 (41.5). MAHER, J. J. **Road construction at Glendalough State Forest.** *Irish For.* 2, 1945 (61–5). [1394].

Notes on the construction of a road and two bridges in the steep, narrow glen of Glendalough, which was necessary to make accessible the young plantations on the upper slopes.

4. FOREST INJURIES AND PROTECTION

4 : 42.5 : 07.7. ROACH, W. A., and ROBERTS, W. O. **Further work on plant injection for diagnostic and curative purposes.** *Tech. Commun. imp. Bur. Hort. Plantat. Crops* No. 16, 1945. pp. 12. [1395].

Improvements in the appliances hitherto developed by one of the authors and his collaborators and used for plant injection with liquid for both diagnostic and therapeutic purposes and with solid materials for therapeutic purposes, are described in detail and fully illustrated. They include the reduction in weight of the small containers employed for intervenal and leaf-stalk injection, by the substitution of cellophane for glass. Special tools for making the cellophane cups are described and illustrated and the sources from which the requisite materials can be obtained are mentioned.

Brief notes are given on the experience gained in both Great Britain and South Africa in the use of injection methods with twenty-five different kinds of plants, including fruit trees and bushes, some forage plants, hops, potatoes, tomatoes, tobacco and a few others. Paged references are given to information contained in previous papers on the subject.

In connexion with injection for curative purposes, an improved method for the injection of solids into a tree is described and figured. It consists in drilling a small hole through the bark, continuing it at a slightly decreased diameter into the wood, introducing, with the help of a metal tube and plunger, the necessary chemicals in tablet form into the wood, and sealing them there with a cork disc over which the bark readily heals. By this method a minimum of mechanical damage is done to the tree.

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.2. *Temperature Influences*

42.21. **Spring frost damage in orchards and its possible prevention.** *Tech. Commun. imp. Bur. Hort. Plantat. Crops* No. 15, 1945. pp. 22. [1396].

This bulletin briefly reviews what has been done and is being done in the way of research on spring frost damage. There are sections on the physiological aspects of frost injury, internal and external factors affecting frost resistance, methods and apparatus for preventing damage, with an extended discussion of orchard heating and the value of smoke screens and chemical mists, to which is added a disclaimer that the fog-dispersal and smoke-cloud equipment used in military operations is immediately adaptable to horticulture. Suggestions are made of subjects for future research, including distribution of frost in space and time under varying conditions; methods of combatting wind frost and particularly the placing of windbreaks so as to prevent wind frosts and yet not create conditions of stagnant, cold air; breeding for late-blossoming varieties and varieties inherently resistant to low temperatures.

42.21 (74.4). MCKENZIE, M. A. **Frost injury to trees.** *Trees, Sta. Monica* 6 (3), 1945 (10–1). [Massachusetts Agricultural Exp. Sta.] [1397].

A short general account of frost damage to trees, with particular reference to effects of a severe frost in Massachusetts in May, 1944.

42.21 (74.8) : 11.22 : 23.1 : 12.25–8 : 45.12 : 23.21. HOUGH, A. F. **Frost pocket and other microclimates in forests of the northern Allegheny Plateau.** *Ecology* 26, 1945 (235–50). [Northeastern Forest Exp. Sta.] [1398].

Open valley bottoms characterize many otherwise forested drainages in the High Plateau section of Western Pennsylvania. Some of these openings have persisted for many years, following the original logging, even though forest growth has been re-established on adjacent slopes. The object of this study was to determine the chief reasons for the failure of natural tree regeneration on these sites. Special consideration was given to local climatic factors and browsing by rabbits and deer.

Weather records kept from 1932 to 1939 in a shallow open valley in the Kane Experimental Forest revealed the greater severity of the microclimate at this station compared with a nearby open site and two forested stations. Lower minimum temperatures during both summer and winter, a much shorter growing season, and greater diurnal ranges in temperature

characterize the frost pocket. The chief influence of topography seems to be stilling of air and slowing down of air drainage, which facilitates both the cooling and the heating of air in the valley bottom.

Dense, compact crown form of Eastern Hemlock (*Tsuga canadensis*) is a good indicator of frost-pocket conditions. Deer and rabbits are factors damaging seedling growth and so help to perpetuate frost pockets. Unfavourable seedbed conditions and scanty sources of tree seed are also important factors in the failure of tree reproduction on such sites.

No quick or easy way to restore forest cover to a frost-pocket opening is known. The most important measures are complete fire protection and exclusion of deer and rabbits so as to preserve the tree growth already existing on the site. Planting of sturdy transplant conifer stock will speed up the process of rehabilitation if frost-resistant, rapidly growing species are used. Red Pine (*Pinus resinosa*) has done well on the better drained areas in spite of frost. Black Locust (*Robinia pseudoacacia*) also has possibilities on dry, barren slopes above frost-pockey valleys. Red Spruce (*Picea rubra*), White Spruce (*P. glauca*), Norway Spruce (*P. abies*), the susceptible European Larch (*Larix decidua*) and Japanese Larch (*L. leptolepis*), should never be planted in frost pockets. All existing tree growth should be saved.

To avoid creation of fresh areas of low productivity, partial cuttings should be the rule in all forests on the High Plateau, especially where the topography favours the formation of frost pockets.

42.22 : 23.26.4. GRIFFITH, A. L. **The effect of a soil stabiliser on plant growth.** *Indian For.* 71, 1945 (209). [1399].

Soil stabilizers, which have been used a great deal in India in recent years to surface mud runways of aerodromes, have had some curious effects on small plants and dormant seeds. In an experiment, which was carried out at Dehra Dun, with seedling peas (*Pisum sativum*), the stabilizer apparently had no significant effect on height growth; however, plants treated with two doses of stabilizer and then left to die of drought lived for 5 weeks after the application, whereas plants that had been treated with plain water, or one dose of stabilizer, lived for only 4 weeks.

This effect was presumably caused by reduction of surface evaporation, and further work is in progress to determine whether the use of soil stabilizers can be developed to enable plants in very dry districts to survive their first critical hot weather.

43. FOREST FIRES

43.0. *Predisposing Factors and Causes*

43.0 (71). CANADA. **Report of the Lands, Parks and Forest Branch for the fiscal year ended March 31, 1944.** *Repr.* from Annual Report of the Department of Mines and Resources, Canada. 1945 (61–107). [1400].

The fire season of 1943 was the most favourable since forest-fire statistics began in 1918. The number of fires (3,370) and total damage and costs ($952,872) were the lowest on record. The area burned (827,830 acres) was the smallest since 1927. The proportion of fires attributed to railway causes (15 per cent.) was the highest since the period prior to 1930 when railway fires were being brought under rigid control. This increase may probably be attributed to greatly increased railway traffic and the use of some obsolete or defective equipment. Smokers' fires show a slight increase in some provinces (p. 98).

43.1. *Protective Measures*

43.13 : 07.7. **Recent developments in portable fire-fighting pumps.** Canadian Pulp and Paper Association, 3420 University Street, Montreal. *Woodlands Section Index* No. 806 (F–3), 1945. pp. [2]. [1401].

Three new forestry-type portable fire pumps are described. The improved model Wajax 'DDVA' Portable Fire Pump, manufactured and distributed by Watson Jack and Co. Ltd., Castle Building, Montreal, has been reduced in weight from 102 lb. to 79 lb. including the petrol tank. The Porto Pump, manufactured by Product Engineering Service, Detroit, has many features specially designed for forest service; final weight, when certain alloys are available, will be 85 lb.; weight of machines at present available is 100 lb. The Macdonald Pack Power Pump, manufactured by Hayes Manufacturing Co. Ltd., 295 West Second Ave., Vancouver, B.C., weighs 70 lb. complete with 10 ft. of suction hose, 100 ft. of discharge hose and petrol tank full. It appears to satisfy

a need for a fire pump of great portability. In some cases it may replace the hand pump and apparently supplies a link between the hand pump and the large forestry pumps.

43.13 : 07.7. EVERTS, A. B. **Why high pressure for fog?** *J. For.* 43, 1945 (629–33). [Snoqualmie National Forest, Seattle, Wash.] [1402].

The value of high-pressure fog in fighting forest fires has been recognized for some time [cf. *For. Abstr.* 6 (113)], but the low-pressure fog nozzle has been less used though it has been used for some time by city fire departments. Since these nozzles operate at a nozzle pressure of 100 pounds, they can be used in conjunction with portable pumpers, tank trucks, gravity hose lays in steep country, and in some cases on ordinary hydrants. Expensive high-pressure pumps and hose are eliminated, and standard pumping equipment and hose are used. A description is given of various types of low-pressure fog nozzles and their operation. The advantages of fog spray over the conventional method of applying water to a fire are summarized.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.1. *Forest Weeds*

44.1 : 12.26–8. STÅLFELT, M. G. Försök över natriumkloratets giftverkan på ljung och blåbärsris. **[Studies on the poisonous effect of sodium chlorate on heather and bilberry.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (260–78). [Sw.sw.e.] [1403].

(1) Heather (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*) will absorb sodium chlorate not only through the roots, but also through the stem and leaves, the poison penetrating with equal facility into the older perennial parts of the stem and into the younger stems and leaves.

(2) The poison absorbed is chiefly carried upwards into the aerial shoots direct, but may also move via the subterranean stems to other aerial shoots. The latter effect occurs if some part of the plant has absorbed a large amount of poison, or if other parts are transpiring actively.

(3) If the poison comes into contact with an aerial shoot, all parts of the latter above the point of contact are killed; thus the lower the affected part, the greater is the effect of the poison.

(4) Sodium chlorate applied in solution to the epidermis takes from a few minutes to about an hour to adhere in sufficient quantity to cause destruction. When applied in solution, e.g. by spraying, the risk of this salt being washed away by rain is negligible, provided that the spraying has not taken place during heavy rain.

(5) Applied in solid form, sodium chlorate acts partly by adhering to the plants, when it usually dissolves during the same day and has the above-mentioned effects, and partly by reaching the subterranean parts after being washed down by rain from the soil surface. Heavy rain immediately after application may nullify the poisonous effect, but the risk of this is small in Sweden, and in any case the fraction of the salt concerned will reach the underground parts only in dilute solution.

(6) Whether the salt reaches the aerial parts in a concentrated form or the underground parts in more or less diluted form, a specific amount must be absorbed by the plant for the effect to be fatal. To destroy bilberry requires an absorption of about 237 mg. per kg. of shrub. Where bilberry occurs at 3 kg. per sq. m., the absorption must be at least 711 mg. per sq. m., or 7·11 kg. per ha., in order to destroy all the shrub. *From author's summaries.*

44.3. *Fungi*

44.3 (56.9) : 12.21. RAYSS, T. Contribution à l'étude des Deutéromycetes de Palestine. **[Contribution to the study of the Deuteromycetes of Palestine.]** *Palest. J. Bot. (Jer. Ser.)* 3, 1943 (22–51 + [4] + plate). [F.heb.] [1404].

The present contribution contains several rare species of fungus and a great number of new hosts for the fungi recorded. Most of the species are reported for the first time in Palestine, and the following new species and varieties are described: *Septoria urticae-pilulifera* sp.n. on *Urtica pilulifera*; *Cercospora judaica* sp.n. on *Vitis vinifera*; *Septoria koeleriae* var. n. *macrocarpa* on *Koeleria phleoides*; *Cytosporina crataegi* f.n. *obesispora* on *Crataegus azarolus*; *Phyllosticta fusiformis* f.n. *microcarpa* on *Eriobotrya japonica*.

44.3 (77.3) : 12.26–8 : 12.21. CARTER, J. C. **Isolations of *Verticillium* from trees and shrubs in Illinois, 1940–44.** *Plant. Dis. Reptr.* 29, 1945 (95–6). I.M.I. [1405].

A table is given showing the number of plants known to be infected with *Verticillium albo-atrum*, or related *Verticillium* species, in various localities in Illinois from 1940 to 1944 inclusive. The host plants listed are *Acer platanoides*, *A. saccharum*, *Berberis thunbergii*, *Campsis radicans*, *Cercis canadensis*, *Diospyros virginiana*, *Ligustrum amurense*, *Rhus glabra*, *Sassafras albidum*, *Ulmus americana*, and *Viburnum* sp.

44.3 : 12.25 : 12.21. MARSHALL, R. P. **Control of cedar-apple rust on Red Cedar.** *Trans. Conn. Acad. Arts Sci.* 34, 1941 (85–118 + plates). [U.S. Bureau of Plant Industry.] L.S. [1406].

Although the most effective way of eradicating Cedar/Apple rust (*Gymnosporangium juniperi-virginianae*) is by the complete removal of one or other of the alternate hosts (Red Cedar and Apple), house owners and the commercial tree experts who serve such owners have demanded control methods which will permit the growing of susceptible species of both hosts in close proximity. In order to meet this demand, experiments with fungicides for the control of the disease were undertaken at Stamford, Connecticut, during the period 1930–40 inclusive. Results indicate that approximately 80-per-cent. control may be obtained through a single application of a modified Bordeaux spray (Bordeaux No. 180) applied in early spring. Where a higher degree of control is demanded for the sake of appearance, it can be obtained by additional applications of the same spray or by hand-picking any galls that appear after spraying. Bordeaux No. 180 has a high copper/lime ratio and contains arsenites. It is non-injurious to Red Cedar and does not make the trees unsightly.

44.3 : 12.25 : 12.21 (485). RENNERFELT, E. Om granens rotröta, dess förekomst och utbredning. [**Spruce butt rot: its occurrence and distribution.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (316–34). [Sw.e.] [1407].

Though no accurate figures are available, losses in Swedish forests from the Spruce butt rot caused by *Polyporus* [*Fomes*] *annosus* are probably very extensive. The fungus normally lives saprophytically on Spruce in stands approaching the age for cutting, probably gaining entrance mainly through dead roots on the underside of the stump. Various types of damage to the more superficial horizontal roots are probably of little importance so far as this fungus is concerned. In certain parts of Sweden the species has appeared parasitically on younger Pine and Spruce and in this form appears to kill the trees rapidly before the typical butt rot develops. Larch has seldom been attacked in Sweden.

Cultures from increment cores have confirmed the presence of the fungus over the greater part of the country. In southern, central, and some parts of northern Sweden it is common, but it has not yet been recorded from the northern granitic area. Temporary sample plots showed very extensive infection in some areas, amounting in severe cases to 50–80 per cent. of the stems. Severe damage is common on old-field and calcareous soils, but has also been noted on sands and moraine soils. Old natural stands in northern and central Sweden seem to be attacked as severely as plantations in the southern region. Less infection has occurred where the preceding crop was Beech, in mixed stands, and in swampy or very damp sites; it is also comparatively rare in stands up to 25–30 years of age.

No direct control measures are possible at present. Mixed stands are to be preferred. If attacks are heavy, a change of species must be considered. Hardwoods such as Oak, Beech and Birch are practically resistant, and of the conifers Larch, European Silver Fir, and normally Scots Pine show considerable resistance.

44.3 : 12.26–8 (66.7). GOLD COAST. **Report on the Forestry Department for the year 1944–45.** Govt. Printing Department, Accra. 1945. pp. 7 [1408].

A serious outbreak of an unidentified fungal disease has occurred in the Achimota Firewood Plantation Reserve. It attacks the cambium, phloem and inner bark of the roots up to the collar of numerous tree species, killing them when it has passed round the collar, where it then fructifies. *Cassia siamea* is very susceptible to it, and it also attacks a number of indigenous species. Neem (*Azadirachta indica*) appears to be immune. One hundred acres (10 per cent.) of the plantation have been destroyed, but the infection has been brought under control by eradication of dead trees and stumps and of infected trees, which are detectable in a fairly early stage by a discoloration on the under-surfaces of the leaves.

Various indigenous species which might replace *Cassia siamea* on this site are being tested for their immunity since Neem, though immune, does not give as high a yield as *Cassia siamea* in this locality. The taxonomy of the fungus is being investigated at the Imperial Mycological Institute, Kew (pp. 1–2).

44.3 : 12.26–8 : 12.21. KOTILA, J. E. ***Rhizoctonia* foliage disease of *Hevea brasiliensis*.** *Phytopathology* 35, 1945 (739–41). [U.S. Bureau of Plant Industry, Beltsville, Md.] [1409].

A description is given of a fungus of *Rhizoctonia* type affecting the foliage of *Hevea brasiliensis*. The causal fungus was isolated from a diseased leaf and its pathogenicity tested on greenhouse-grown, rubber-plant seedlings. From a resulting spot the fungus was re-isolated and used to inoculate young and old leaves as before. At 21° to 25° C., and with relative humidity at 90–100 per cent., infection of young leaves took place in 5 days.

44.3 : 12.26–8 : 12.21. LOPES PIMENTEL, A. A. Primeiras notas para o estudo duma doença do castanheiro e nogueira, nos viveiros florestais, causada por um ficomiceta. **[Preliminary notes for the study of diseases of Chestnut and Walnut in forest nurseries caused by a phycomycete.]** *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (468–9). [Port.] E.M.B. [1410].

Observations carried out by the Portuguese Forest Services on a previously unidentified disease of Chestnut (*Castanea sativa*) and Walnut (*Juglans regia*) in nurseries of the first Forest Division in the north of the country. A description is given of the pathological symptoms, which are identical in both of the parasitized species. From the material collected, a phycomycete (possibly a race of *Phytophthora cambivora* (Petri) Buis. identical with that isolated in France by Dufrenoy) was isolated in pure culture. The morphological and cultural characteristics of the fungus are described. Experimental inoculations of *Castanea sativa* indicate that it is a parasite of extreme virulence.

44.3 : 12.26–8 : 12.21. SLEETH, B., and LORENZ, R. C. ***Strumella* canker of Oak.** *Phytopathology* 35, 1945 (671–4). [U.S. Bureau of Plant Industry, Beltsville, Md.] [1411].

Saplings of the following species were inoculated in the autumn of 1934: *Quercus alba*, *Q. montana*, *Q. borealis* var. *maxima*, *Q. coccinea*, and *Q. velutina*. Most of the inoculations were made with cultures isolated from typical *Strumella* cankers from different Oaks, but a few were made with spores from freshly collected fruiting bodies of *Strumella coryneoidea* found on dead Oak branches. Initial canker development was secured in most cases, and the cankers formed yielded *Strumella* in culture. There was no indication that an isolate from one species of Oak was more virulent than one from any other. The results indicate that the fungus is not a highly specialized parasite.

44.3 : 12.26–8 : 12.21. TYLER, L. J., and PARKER, K. G. **Factors affecting the saprogenic activities of the Dutch Elm disease pathogen.** *Phytopathology* 35, 1945 (675–87). [Department of Plant Pathology, Cornell Univ., Ithaca, New York.] [1412].

The Dutch Elm disease fungus (*Ceratostomella ulmi*) lives as a saprogen for a considerable part of its normal life cycle. The purpose of this paper is to help elucidate the effects of temperature and moisture on the saprogenic growth and survivability of *C. ulmi*. It was found that the optimum temperature for the germination of coremiospores was 27° C. At 18° C. and lower, the spores tended to bud. Minimum temperature for growth of mycelium lay between 1° C. and about 3° C., optimum temperature was about 27° C., and the maximum was between 33° and 36° C. The optimum temperature for development of coremia was about 24° C. Coremiospores of *C. ulmi* germinated well at relative humidities of 98 per cent. and lower. When vitally established in the form of spores and mycelium in diseased Elm, the organism grew over the surface at relative air humidities of 92 per cent. and higher. Growth was very sparse at 92 per cent., fair at 96 per cent. and abundant at 98 and 100 per cent. *C. ulmi* lived for at least 2 years in diseased Elm wood that was protected from rapid loss of water and from abnormally high temperatures. From the point of view of disease control this is unfortunate because it means that dead, dying and decadent Elm material of all sorts that has not been barked may constitute a source of inoculum. However, the inability of the organism to withstand rapid and prolonged drying, even when embedded in wood, is a characteristic that renders it vulnerable. It is suggested that this fact might be made use of in sanitation work against the disease.

44.4. *Virus Diseases*

44.4 : 12.26–8 (77.3). CARTER, J. C. **Dying of Elms in Illinois.** *Plant Dis. Reptr.* 29, 1945 (23–6). [Illinois Natural History Survey, Urbana, Ill.] I.M.I. [1413].

Although at intervals during the past 14 years numbers of Elms have died in and near large cities in Illinois, it was not until 1944 that the dying of Elms became general over a wide area in the southern two-thirds of the State. A table is given showing the numbers of diseased Elms found in 49 localities in 24 counties from 1939 to 1944. Patch-grafting experiments to determine the presence of phloem necrosis in Illinois were started in 1939. Most rapid reproduction of the disease was obtained in 1944 when greenhouse trees that were patch-grafted with diseased bark in May developed symptoms of phloem necrosis in August and died in late August and early September.

45. DAMAGE BY ANIMALS

45.1. *Mammals*

45.11 : 12.26–8 (75.6) 34.21. BISWELL, H. H., and HOOVER, M. D. **Appalachian hardwood trees browsed by cattle.** *J. For.* 43, 1945 (675–6). [Appalachian Forest Exp. Sta., Asheville, N.C.] [1414].

In connexion with watershed management studies at the Coweeta Experimental Forest in western North Carolina, observations were made during the summers of 1941 and 1942 in an area of hardwood forest which was fenced and very heavily grazed, in order to determine which plants were preferred by cattle, and to what extent trees were browsed. The tabulated results show that under intensive stocking some species of trees in Appalachian hardwood forests are browsed heavily, whereas others are not browsed at all. Yellow Poplar (*Liriodendron tulipifera*) stands had 75 per cent. of trees under 5 ft. killed in the first year. Those that survived were greatly weakened, as was shown by the late and small leaves next year. Many trees 12–15 ft. high and 1–1½ in. in diameter were killed by being ridden down and defoliated. Other trees appreciably damaged in the first year were Black Locust (*Robinia pseudoacacia*), Ash (*Fraxinus* spp.) and Sourwood (*Oxydendrum arboreum*). The grazing capacity of this 145-acre tract decreased about 50 per cent. in one year as a result of heavy grazing; in 1941 it furnished about 1,000 cow days of grazing, and 1942 only 500. The authors believe that such areas can be used for cattle grazing without excessive damage to timber values, if the season of use and degree of cattle stocking are based on the available broad-leaved herbs and grasses which are preferred by the cattle.

45.12 : 12.25 : 13.2. SCHANTZ-HANSEN, T. **Red squirrel damage to mature Red Pine.** *J. For.* 43, 1943 (604–5). [Univ. of Minnesota.] [1415].

A note on the activities of red squirrels observed at the Cloquet Forest Experimental Station in 1943. During December the squirrels cut off the tips of branches of mature Red Pine, but apparently made no attempt to collect or eat any of them. Collections were made under 4 typical trees, and it was found that an average of 67 tips was cut from each tree.

45.12 : 12.25 : 13.2. NORSTEDT, G. Ekorren som skadegörare på tall. **[Damage to Pine by squirrels.]** *Skogen* 32, 1945 (311). [Sw.] [1416].

The damage consisted in the stripping of portions of the thin bark from the stem within the crown during the period of sap flow. Local people state that squirrels have been observed to strip the bark with teeth and claws and lick its inner surface. Over 5,000 (or 31·5 per cent.) of the Pine trees on an area of 6·1 ha. were so damaged. The percentage of damaged Pine stems in the component stands was 27·1 for a 15-year-old open Pine plantation, 34·0 for a 20-year-old mixture of Pine, Spruce and Birch, and 31·5 for a 35-year-old mixture of Pine and Spruce.

45.12 (78.9) : 23.1 : 12.25 : 13.2. KRAUCH, H. **Influence of rodents on natural regeneration of Douglas Fir in the southwest.** *J. For.* 43, 1945 (585–9). [Southwestern Forest and Range Exp. Sta., Tucson, Ariz.] [1417].

This article shows that cut-over stands of Douglas Fir in the south-west United States are not re-stocking satisfactorily because of the destructive work of mice. It was found that mice can be effectively controlled by poisoning, using thallium sulphate applied to sunflower seed as a bait. The author suggests that cut-over areas should be poisoned in years when good seed crops occur. For uncut virgin stands, he suggests that light cutting and the most complete possible disposal of slash and

cull material may be all that is required to control rodents.

45.3. *Insects*

45.3. SCHWERDTFEGER, F. Untersuchungen über die Eignung von Gesarol zur Forstschädlingsbekämpfung. **[Investigations into the suitability of Gesarol for the control of forest pests.]** *Forstarchiv* 20, 1944 (161–2). [G.] [1418].

The substance known as Gesarol was developed by the firm of Geigy of Bâle, and the Berlin firm of Schering were licensed to manufacture it. The active ingredient, pentachlordiphenylethane, is a highly effective contact and stomach poison for most arthropods, but, at the same time, largely non-toxic to vertebrates (including man) and plants. The preparation is obtainable either as a dust or as a spray. Gesarol in powder form was tested in 1943 and 1944 at the Institute for Forest Protection, Eberswalde, partly in the laboratory and partly in the field, application being made both by motor duster and by aeroplane, and it was established that it has a very wide range of effectiveness. Of 75 distinct species of forest insects, 70 were found to be susceptible and only 5 resistant. Besides insects, it exterminates millipedes speedily and spiders partially. Frogs, toads and lizards can undergo severe dusting without suffering harm. According to the dosage, Gesarol exhibited fair, good or excellent results against forest pests, particularly in the young stages. The following insects proved to be susceptible: the caterpillars of the Larch Miner Moth, Pine Looper Moth, Pine Noctua, Nun Moth, and Pine Hawk Moth, larvae of various species of Pine Sawfly, Cockchafer, and Pine Weevil. The list could be greatly extended, but it is certainly established that Gesarol is well fitted for use in forest protection so far as its effectiveness against insect pests is concerned.

The effect of the preparation against other forms of life must also be taken into consideration. There is no doubt that it is innocuous to plants and vertebrates. Field experiments, however, made it clear that dusting with Gesarol effects a widespread reduction in arthropod fauna and an impoverishment of the biocoenosis, the extent of which is as yet unknown, especially as the experiments hitherto made were on small areas which could be quickly replenished from the animal life of adjacent areas. Tachinidae and Ichneumonidae are very susceptible, while some pests, for example the larvae of the Web-spinning Sawfly, are only slightly affected. By dusting the latter, therefore, it is quite possible that one might leave a high percentage of the pest alive whilst killing its parasites.

45.3 : 12.25 : 13.2. BERNSTRÖM, N. Flyget rädder skogen. **[The aeroplane saves the forest.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (79–83). [Sw.] [1419].

Dusting from the air was first used in Sweden in the summer of 1944 against mass infestations of *Bupalus piniarius* [cf. *For. Abstr.* 6 (260); 7 (103)], using Gesarol as there were legal obstacles to the use of arsenicals. At Hökensås, Gesarol was used at the rate of 8 kg. per ha. Marking of the dusting site was done with balloons. The aeroplane was directed by radio, using two links—a short-wave link between the plane and a control station, and an ultra-short-wave link between the latter and a special observation tower in the forest. The flying height varied between 5 and 10 m. above the tree tops. The trail of powder was observed to spread at a constant rate, so that in still weather only flying height would affect the density of dusting. The dust was sufficiently heavy to sink even with strong convection currents, and in otherwise favourable weather treatment can be carried on throughout the day. With light wind the added spread due to obliquity is partly compensated for if the distance between runs is the same as in still weather. A new dusting apparatus was designed for this work: the dust container had arrangements for agitating the dust to avoid lumps, and the dust was screw-fed to a vertical tube leading into a horizontal blower tube worked by the air pressure developed in flight. Further improvements have been made to this apparatus, as it was found that it was very important to keep the dust finely divided and homogeneous and that the shape and size of the blower had a great effect upon the evenness and density of dusting.

45.3 : 12.25 : 13.2 : 12.11.3 : 12.14.4. AUSTIN, L., YUILL, J. S., and BRECHEEN, K. G. **Use of shoot characters in selecting Ponderosa Pines resistant to resin midge.** *Ecology* 26, 1945 (288–96). [Institute of Forest Genetics, California Forest and Range Exp. Sta., Placerville, Calif.] [1420].

The Institute of Forest Genetics, California, has begun studies with the object of producing strains of Ponderosa Pine (*Pinus ponderosa*) resistant to the very destructive resin midge (*Retinodiplosis* sp.), which lays its eggs on young twigs. The larvae feed beneath the epidermis, retarding growth, causing deformities, and even killing some trees. An experimental survey of a young Ponderosa Pine plantation consisting of 1,100 trees with strains from 13 of the western United States and from British Columbia revealed that at 10 years old, midge injury had become very severe on susceptible forms, while other forms, equally scattered, were not attacked at all. Observations 2 years later indicated a striking correlation between the amount of injury and the surface condition of the new shoots. Trees having new shoots that were glaucous or glabrous were injured little if at all, while trees having shoots that were viscid suffered greater damage. 93·4 per cent. of the glaucous trees were either immune or lightly attacked, whereas only 11·2 per cent. of the viscid trees were immune or lightly attacked and the rest were seriously injured. Hence trees susceptible to resin-midge attack might be quickly selected for removal from the stand by observation of the surfaces of the shoots, and the same criterion might be used in the selection of seed trees.

45.3 : 12.25 : 13.2 (71.1 : 71.11). HOPPING, G. R., and MATHERS, W. G. **Observations on outbreaks and control of the Mountain Pine beetle in the Lodgepole Pine stands of Western Canada.** *For. Chron.* 21, 1945 (98–108). [Dominion Entomological Laboratory, Vernon, B.C.] [1421].

An operation to control an outbreak of the Mountain Pine beetle (*Dendroctonus monticolae* Hopk.) is now in progress in the stands of Lodgepole Pine (*Pinus contorta* var. *latifolia*) of Banff National Park, Alberta. This paper reviews the history and the probable underlying causes of such outbreaks in Western Canada and the results so far obtained by the control works. It is suggested that drought may be the main underlying cause of the infestations. The decking and burning method has been used throughout the operation, except in the immediate neighbourhood of Banff, where it was possible to salvage about 500 trees and grub up the stumps. All other stumps were slabbed off to ground level and the slabs burned in the piles. 'Red tops' as well as green infested trees were treated.

Experience with the Banff project and with others in the past has led to the following conclusions. Control work must be started when the first signs of abnormal bark-beetle increase become apparent. Control work on large areas is unlikely to succeed if infestation has reached an average of 5 green trees per acre. The control area must be geographically isolated from any other source of infestation, either by a high mountain barrier or by a distance of 30 miles or more. Control work must be continued as long as the underlying causes are operative; in the Banff area it is believed that this will be until there has been an annual precipitation of at least 18 in. for several years. Every infested tree and the entire area must be covered. It is advisable to remove every tree showing any sign of attack. The trees should be completely burned and any trees scorched by fire should be felled and burned. As long as the character of the stand remains the same, future outbreaks may be expected wherever tree vigour is reduced, and the only permanent solution is to change the composition of the stand, gradually establishing a mixed stand.

45.3 : 12.25 : 13.2. **Fighting looper infestation.** *W. Cst. Lumberm.* 72 (7), 1945 (94). [1422].

An outbreak of Western Hemlock looper (*Ellopia fiscellaria* var. *lugubrosa* Hulst.) is in progress in Oregon, about 12,000 acres being infested. Timber losses are heaviest in sheltered drainage areas protected from westerly winds. With a few exceptions only old-growth or old second-growth trees have been attacked. Defoliated trees soon die, but almost all killed timber can be utilized if salvage is undertaken immediately. Costs of artificial control measures are estimated at $2.00 per acre with D.D.T. and $4.00 per acre with lead arsenate, including cost of insecticides, application by aeroplane, and incidental expenses of loading planes, transport, storage, and use of airfields.

45.3 : 12.26–8 : 13.2. BAETA NEVES, C. M. Um ensaio de luta contra a *Lymantria dispar* L. por meios fisicos. **[An attempt to control *Lymantria dispar* L. by physical means.]** *Abstr.* in *Rev. agron., Lisboa* 30, 1942 (455–6). [Port.] E.M.B. [1423].

In a 50 × 50 m. plot containing 22 Cork Oaks of different ages and sizes the author tried a treatment against *Lymantria dispar* consisting of scorching infected trees (after pruning) with the flame of a blowpipe.

The treatment was divided into 3 parts: (1) up to 2·30 m.; (2) 2·30–4 m.; and (3) above 4 m. After a rapid trial the author decided that a few seconds was sufficient, from the point of view of efficacy, to hold the blowlamp over the infested areas. These were generally localized on the underneath parts of the branches. The principal difficulty was in the third phase of the treatment, which must be carried out from below upwards. Owing to the lack of certain details, it is impossible to draw definite conclusions as to the value of the process economically.

45.3 : 12.26–8 : 13.2. SCHWEIG, K. **The Elm beetle.** *Hassadeh* 25, 1945 (106). [Heb.] L.S. [1424].

45.3 : 12.29 : 13.2. KELSEY, J. M. **A termite damaging Coconut palms on Suwarro Island: *Calotermes* (*Neotermes*) *Rainbowi* Hill.** *N.Z. J. Sci. Technol.* 27B (1), 1945 (69–75). P.R. [1425].

This termite is recorded for the first time in the Danger Group of islands in the Pacific Ocean. Infested coconut palms should be injected with arsenic dust; this method proved completed successful in Ceylon. All breaks in the living tissue should be sealed with kauri gum, resin, castor oil and beeswax. The termites seldom attack the living tissues of the tree.

47. COLLECTIVE INJURIES TO INDIVIDUAL TREE SPECIES

47 : 12.26–8 (71.6) : 45.3. NOVA SCOTIA. **Report of the Department of Lands and Forests, 1944.** King's Printer, Halifax, N.S. 1945. pp. 181 + plates + tables. [1426].

In 1939 the Birch of Nova Scotia had hardly been affected by die-back, but by 1944 the disease had spread throughout the Province. The bronze Birch-borer (*Agrilus anxius*) is often associated with the injury, although this insect normally prefers weakened or dying trees and would not seem to be responsible for all the damage to Birch stands. A number of trees showing die-back, but with only one-quarter or less of the crown dead, have been examined and either no borer galleries were found or not enough to explain the amount of damage. A number of factors may have combined to produce the present condition, including repeated attacks by foliage-feeding insects such as *Bucculatrix canadensisella*, *Fenusa pumila*, *Phyllotoma nemorata*, *Coleophora salmani* and *Corythucha pallipes*; a series of droughts accompanied by high temperatures and winds between 1930 and 1936; the accumulation of mature and overmature stands; exposure as a result of cutting softwoods from mixed stands. Combinations of these factors might account for the localized occurrences of die-back, so that fairly large quantities of food material might be made available for the borer or some other insect. On the other hand, the absence of borer in some of these trees suggests that the initial phases of the disease may be due entirely to physiological upset or disease. Evidence of what may prove to be causative organisms was found this year in dead twigs and small branches of trees and seedlings which contained no borers. One of these organisms has been identified as the fungus *Gelatinosporium fulvum*, the imperfect stage of *Dermatea molliuscula*. In 1943 a series of permanent plots was initiated in New Brunswick and Nova Scotia for the study of Birch decadence. It is too early yet to report on work on these plots. Only general recommendations can as yet be given for stopping die-back of Birch. It is advisable to remove weak and dying trees in cut-over areas and farm woodlots. When areas are to be heavily cut, unmerchantable trees should be removed also. Old-growth, even-aged stands should be clear-cut; in all-aged stands, group cutting should be practised. In second-growth stands decadent trees should be removed in improvement cuttings. In selection cuttings care should be taken not to expose Birch severely (pp. 46–54).

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52 : 12.25. HAGBERG, N. Mätning av rotansvällningen hos tall och gran. [**Measurement of the root swelling in Pine and Spruce.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (409–22). [Sw.sw.] [1427].

Methods of determining the 'normal' diameter (after deduction of root swelling) are discussed on the basis of analyses of two Pine and two Spruce stands in different localities. Determination by functions expressing 'normal' diameter as diameter to be callipered direct at a point, termed 'measurement height', of varying distance above breast height, was superior in accuracy to the use of simple empirical factors, to callipering at 1·7 instead of 1·3 m., and to a combination of these two methods.

Taper of the root swelling was found to be several times that of Höjer's 'normal' stem.

A brief account is also given of the height of the root swelling and its volume in the material investigated.

52.2. *Height. Length*

52.2 : 07.7. SPURR, S. H. **The Navy hypsometer.** *J. For.* 43, 1945 (517–8). [Harvard Forest.] [1428].

The 'Position Angle Finder' of the U.S. Navy is decidedly superior to the Abney level, the U.S. Forest Service hypsometer, and other standard devices for measuring the height of trees. The instrument is similar to the hypsometer in principle, but is superior in that (1) the field of vision is extremely wide, (2) angles up to 90° can be read easily and accurately, (3) the graduated scale is optically superimposed upon the field of vision, thus imposing no obstruction, and (4) the weighted drum revolves in a liquid which effectively damps vibrations and fluctuations. This instrument, which is manufactured by the Polaroid Corporation of Cambridge, Mass., can be used without modification provided that the observer carries a table for converting degree readings to height in ft. for measurements taken 100 ft. (or any other standard distance) from the tree.

52.4. *Measurement of Volume*

52.4 : 57.4. **Interpolated volume tables (total volume) for use in compilation of sample plot data.** *Misc. Ser. Dom. For. Serv.* No. 3, 1944. pp. [23]. [1429].

Since volume tables ordinarily show volumes in 10-ft. height classes, it is necessary to interpolate in order to obtain values for each foot of height. This method not only takes time, but is also liable to introduce errors. A set of volume tables suitable for sample-plot stands anywhere in Canada has accordingly been selected, and for each of these tables, values for each inch in diameter and each foot in height have been interpolated and tabulated up to 20 in. d.b.h. and 100 ft. height, for various form classes of the following species: Jack Pine, Red Pine, White Pine, Lodgepole Pine, Red Spruce, Black Spruce, Balsam Fir, White Cedar, Paper Birch, Yellow Birch (can be used for Elm), Aspen (can be used for Ash), Maple (can be used for Oak and Ironwood), Beech, and Basswood.

52.42 : 56.04 : 07.7. GEVORKIANTZ, S. R., and AAMODT, E. E. **Volume-growth slide rule.** *J. For.* 43, 1945 (652–3). [Lake States Forest Exp. Sta., St. Paul, Minn.] [1430].

The authors have devised a special pocket-size slide rule for quick and simple computation of volume and growth of trees in the field. By three simple manipulations of the slide, after the log height, the d.b.h., and the diameter increment of the tree are known, the volume, growth, and growth per cent. can be determined in a few seconds. The rule is founded on the composite volume table (Scribner Rule) previously developed for use on the forest survey, which was found to apply to nearly all important hardwoods and softwoods in the Lake States [cf. *For. Abstr.* 4 (191)]. A detailed description is given of the rule, its assembly, and operation.

52.43.5 : 01.7. HAGBERG, N. Några undersökningar och uppgifter rörande taxering med cirkelprovytor. [**Some investigations and data concerning enumeration with circular sample plots.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (335–43). [Sw.sw.] [1431].

A report on preliminary trials of enumerations with regularly distributed circular sample plots in two separate districts of Sweden.

Consideration is given to the treatment of marginal trees, here taken as trees with ½ or

more of their basal area within the plot boundary. It is shown that if two circular plots are laid out adjacent to each other and a marginal tree included in the one and excluded from the other, a systematic error results, equal to πr^2 per circle where r is the radius of the marginal tree.

The material and results are discussed, and it is shown that the standard deviation increases with increasing plot size and varies also with factors such as age, volume per ha., number of stems, mean diameter, and density. The verification and amplification of such data will furnish a basis for the calculation of the number of plots required.

Combination of the standard deviations for a number of stands may be effected with the aid of the formula:

$$\sigma=\sqrt{\frac{p_1(\sigma_1^2+k_1^2)+p_2(\sigma_2^2+k_2^2)+\ldots+p_n(\sigma_n^2+k_n^2)}{p_1+p_2+\ldots+p_n}}$$

where σ = the desired common standard deviation; σ_1, σ_2, σ_n = standard deviations for the first, second and nth stands respectively; p_1, p_2, p_n = areas of the first, second, and nth stands respectively; and k_1, k_2, and k_3 = correction factors for the same, obtained as the difference in volume per unit area between the common mean for all stands and the means for the individual stands.

The number of sample plots required for a given degree of accuracy may now be determined from the formula $^{\epsilon}M=\frac{\sigma}{\sqrt{p}}$, where $^{\epsilon}M$ is the standard error of the mean (permissible degree of error × common mean of volume per plot for all stands) and p is the number of sample plots.

The stated limits of error are discussed with reference to the material used, but no consideration is given to the advantages or disadvantages of circular-plot enumeration as compared with other methods.

52.46 (54.8) : 12.19.2. GRIFFITH, A. L. **The efficiency of enumerations. I. The problem. II. and III. Madras tropical wet evergreen forest. Typical calculations. IV. Madras moist mixed deciduous forest.** *Indian For. Leafl.* (*Silviculture*) Nos. 83, 84, 85, 1945. pp. 6 + 21 + 26. [Forest Research Institute, Dehra Dun.] [1432].

The sixth silvicultural conference, held at Dehra Dun in 1945, authorized the Central Silviculturist to examine existing data at once and to indicate as soon as possible the probable accuracy of different methods and intensities of enumeration in different types of forest and terrain. Information is being sent out in a series of leaflets of which these are the first. When the whole investigation has been completed, it will be written up in detail as an *Indian Forest Record*. Leaflet No. 83 (I) sets out the need for data, the types of error which occur in enumeration work, and the limitations of accuracy and precision attainable. Sections II and IV deal respectively with tropical wet evergreen forest and moist, mixed deciduous forest in Madras. After a description of the areas concerned and the data available, the leaflets show what errors in estimations of total volume would have occurred had sampling enumerations of different intensities been carried out instead of 100-per-cent. enumerations. Other types of forest and terrain may give different results, but the following indications can be seen from the work so far done. 100-per-cent. enumerations are not necessary in order to obtain a reasonable estimate of the growing stock. For practical purposes, 5–10 per cent. in evergreen and 2½–5 per cent. in moist deciduous forest are probably sufficient. Systematic sampling gives more accurate and precise estimations than random sampling, provided that it is carried out with full appreciation of the probable trends of the fertility gradients of the forest. Whatever the intensity of enumeration, some 30 separate estimates of the volume per acre in each square mile of evergreen forest and some 10 separate estimates per sq. mile in moist deciduous forest, will probably give a sufficiently accurate estimate of the total volume and enable a calculation to be made of its precision. In an average province with a working-plans circle dealing with the preparation or revision of some 6–10 working plans a year, one computor and one assistant computor could probably deal with all the necessary computing work. Section III (which is issued with Section II in Leaflet No. 84) gives examples of typical calculations used in the examination of the data of the Madras wet evergreen forest.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

57 : 12.25 (47.3). TIMOFEEV, V. P. **Plodȳ nauchnoy rabotȳ. Vos'midesyatiletie lesnoy**

opytnoy dachi T.S.Kh.A. **[Results of scientific work. Eightieth anniversary of the experimental forest of the Moscow Academy of Agriculture.]** *Lesnaya Prom.* No. 12, 1944 (16–9). [Russ.] [1433]. .

A discussion of mensurational data for Pine, Spruce, Siberian and European Larch, in the experimental forest of the Moscow Academy of Agriculture, which illustrate the comparative development of these species over a period of 80 years in four stands of the same age and density, and on comparable sites.

(1) The chief growth figures for the different species at 65 years of age, when the fullest data were available, are: (i) *Mean diameter* (cm.):—European Larch 30·2, Siberian Larch 26·6, Spruce 20·1, Pine 23·2. (ii) *Mean height* (m.):–European Larch 27·9, Siberian Larch 26·3, Spruce 23·6, Pine 24·0. (iii) *Growing stock* (cu.m.):—European Larch 530, Siberian Larch 490, Spruce 550, Pine 425. (iv) *Total yield* (cu.m.):—European Larch 650, Siberian Larch 640, Spruce 610, Pine 530. The total yield by weight, however, was higher for Siberian than for European Larch.

(2) For good natural pruning and yield of high-grade timber, Siberian Larch takes the first place, Spruce the second, European Larch the third (owing to crooked stems), and Pine the fourth. The yield of grade I logs from the Siberian Larch stand at 60 years was 3 times that from the Pine stand; and that from the Spruce 2½ times that from the Pine stand. Spruce had the least taper, followed in increasing order by Siberian Larch, European Larch, and Pine.

(3) Siberian Larch produced the highest-grade timber and the physico-mechanical properties of the wood of both species of Larch were considerably better than those of Pine and Spruce. The basic values for timber properties were about 50 per cent. better for Siberian Larch, and 35 per cent. better for European Larch, than those of Pine.

(4) Since both the volume and quality yield of the Larch species are considerably higher than those of Pine and Spruce, both species are recommended for wide use on well drained suglinok and sandy soils in the mixed-forest zone of the U.S.S.R.

It is noted that during the drought of 1938–39 in Moscow and adjacent provinces nearly all the species suffered, especially Spruce, but Larch survived both heavy frosts and drought.

57 : 22.83 : 64 (485). ENANDER, M. **Produktionen i mellansvenska blandskogar. [Yield in Central Swedish mixed coniferous forests.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (84–9). [Sw.] [1434].

Yield data for site quality IV (ideal 4·5 cu.m. per ha. per year) are compared, chiefly on the basis of the author's results for Lisjö, Bjurfors, and other central Swedish forests, and those elaborated by Hagberg from data provided by the State Forest Survey [see *For. Abstr.* 1 (52)]. The general agreement is good, and the differences arise mainly from the inclusion by the State Forest Survey of many private forests, particularly farm forests, where grazing and other practices have affected the stocking.

57 (71.1) : 12.19 : 74.2 : 65. GILMOUR, J. D. **Observations on the growth of the next forest crop in the Lower Fraser Valley and Southern Vancouver Island.** H. R. MacMillan Export Company Limited [Vancouver, B.C.] 1945. pp. 24. [1435].

The object of this pamphlet is to show that in the Coast Forest District of British Columbia, the annual growth per acre is rapid and valuable. Data are given from 10 sample plots of second-growth forest in the Lower Fraser Valley and Vancouver Island, and comparable data from permanent sample plots in Oregon and Washington. The rate of tree growth in Vancouver Forest District compares favourably with that in Washington and Oregon and is much faster than anywhere else in N. America east of the Cascade Mountains. Though the areas were originally of the Douglas Fir type, many of the plots are now of the Hemlock type. Hemlock is crowding out Douglas Fir on much cut-over and burned-over land and may constitute as much as 75 per cent. of the next crop on land which previously carried a predominantly Douglas Fir forest. The growth of Hemlock per acre is about 40 per cent. higher than that of Douglas Fir on similar sites. Cedar (*Thuja plicata*) is also increasing in proportion, although it does not often become the dominant species. It may in many cases furnish an interim pole crop, in 50–60 years, which will assist financially in carrying the Hemlock and Douglas Fir to an age at which the return on those species is at the highest point.

57.9 : 65.7. MULLOY, G. A. **Empirical stand density yield tables.** *Silvic. Res.*

Note Dom. For. Serv. No. 73, 1944. pp. 22. [1436].

It is probable that, in the post-war period, a new and better inventory of Canadian forest resources will be attempted, and the basis of such a survey will be aerial photographs, ground survey work being chiefly restricted to obtaining growth expectancy data and occasional checking of cover and site types. The various methods of determining growth rate are reviewed and it is concluded that the best method is the use of empirical stand-density yield tables. The method has the advantage that the tables are constructed wholly on samples mechanically selected for each topographical site type. Since they take density into account, they may be applied to understocked stands of mixed age and species. The addition of a measure of density in the stand-density yield tables produces a table embracing the entire ranges of both empirical and normal tables, as well as evaluating the density factor. The principal weakness in all yield tables is that they do not allow for changes in density of any stand, and probably the only means of determining this factor is by means of permanent sample plots. In undisturbed stands, however, the change in Stand-Density Index is slow and, since an inventory should be repeated at, say, 15-year intervals, the effect of change in Stand-Density Index should not be great in short-period growth estimation.

The method of preparing and applying the tables is described and examples are given for the Jack Pine, White Pine/Red Pine and Balsam/Spruce types. The method will reduce the amount of field work but will involve additional work in preparing yield tables. Ground examination should consist in sampling representative types and sites shown in aerial photographs, by means of transect plots. All calculations should be done at a central office or offices, and not in the field.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.1. *Management of Non-forest Land*

60.1 : 34.21. HUMPHREY, R. R. **Some fundamentals of the classification of range condition.** *J. For.* 43, 1945 (646–7). [Soil Conservation Service, Wenatchee, Washington.] [1437].

It is emphasized that classification of range condition is basically a classification of site, in terms of its present production as compared with the maximum production possible under the best practical management. Each area must be rated on its own potential production and cannot be rated by comparison with some other area which may differ in climate, exposure, soil, or any other factor affecting plant growth, and consequently forage production.

60.3. *Management of Different Classes of Forest*

60.3 (485) : 02.1. HAGBERG, N. Skogsindelning. **[Forest management.]** Svenska Skogsvårdsföreningens Förlag, Stockholm. 1943. pp. 215. [Sw.] [1438].

This book aims at giving a comprehensive account of the bases and practical development of forest management for different types of forestry enterprises in Sweden, where no general work on the subject has hitherto appeared. The first part is theoretical and contains (*a*) an historical review with chapters on Central European methods, developments in Sweden, and the concept of the normal forest, and (*b*) an examination of the foundations of management with chapters on the background of management, principles of treatment, determination of cutting requirements, planning method, and mathematical accuracy. The practical part of the work comprises sections on (*a*) survey and inventory, with chapters on mapping, assessment of area, description of stand and site, determination of growing stock and increment, summary statements, rates of work and costs in pure management operations, and photogrammetry; (*b*) planning, with chapters on processes involved, the technique of calculation, and examples of the calculation of fellings; (*c*) the preparation of the working plan, with chapters on description, working prescriptions, and control of operations and capital; and (*d*) brief discussions of types of management organization applicable to different enterprises such as small estate forests, crown forests, etc.

61. SURVEYING. MAPPING

61.32. THOMAS, H. H. **Recent developments in air photography.** *Nature, Lond.* 156, 1945 (409–11). [1439].

The article gives a general review of the use of air photography for intelligence work during the war and some account is given of technical developments. At the outbreak of war cameras of the type then in service were very largely used, but new types of lenses of long focal length were used in them. They have automatic operation with distant control and a magazine of film for 250 exposures. Later a new type, with a magazine holding 500 exposures, was brought into service. The cameras were generally mounted in the aircraft with the optical axis vertical, or slightly tilted so that by the simultaneous use of two instruments greater lateral cover could be obtained. For low-level photographs, cameras were installed in an oblique position in the fuselage or under the wings; valuable work was done with two synchronized cameras facing downwards and giving stereoscopic results. Special heating arrangements had to be devised to ensure the efficient operation of cameras at very low temperatures.

Methods have been devised for processing exposed films so that a negative with a very fine grain can be produced in a minimum period of time. In view of all the operating conditions panchromatic material proved to be the most useful, but infra-red film was sometimes used, and colour film has been recently employed for special tasks.

Some of the subjects investigated by aerial photography are mentioned and the interpretation of prints is described.

A plea is made for the establishment of a national photographic reconnaissance unit in Great Britain, the results of which should be kept in a library similar to the Canadian National Library of Air Photographs at Ottawa.

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

64 : 11.4 : 56.03 : 12.25–8 (74.6). LUNT, H. A., and BALTZ, M. C. **Basal area in relation to soil-site factors in two Connecticut forests.** *Proc. Soil Sci. Soc. Amer. 1943* 8, 1944 (415–9). [Connecticut Agricultural Exp. Sta., New Haven, Conn.] L.S. [1440].

Four forest tracts of even-aged mixed hardwoods were studied for the purpose of correlating forest composition with general soil-site conditions irrespective of soil type *per se*. Using the strip method, the areas traversed were mapped on the basis of depth of solum, moisture conditions, slope and aspect, humus type, and thickness of the humus layer. The many varieties of soil-site conditions found in the field were ultimately reduced to five. Differences in average basal area per chain, 1 rod wide (1/40 acre), on the several site conditions were subjected to the *t* test for significance.

Fifteen species composed 87·9 per cent. of the total basal area of all tracts.

Comparison of the average basal areas of the first 10 species on the four tracts and on the two most common site conditions by the analysis of variance showed no significant difference between tracts, nor between site conditions.

Comparison of specific soil-site conditions by single species showed the following relationships: (*a*) Chestnut Oak and Black Oak had significantly higher basal areas on the drier soils, while Red Maple, Yellow Birch, Aspen, and Blue Beech excelled on the moister sites. (*b*) Comparison of shallow and deep soils showed that Black Birch, Red Maple, White Oak, Black Oak, Scarlet Oak, Tulip, Gray Birch, and Pignut Hickory were more abundant on the deep soils, particularly on the drier sites. (*c*) White Oak was the only species with greater basal area on steep north slopes.

No correlation was evident between the kind and amount of humus and forest composition. Sixty per cent. of the area surveyed consisted of one humus type, laminated mor. Ferns appeared to be more plentiful on moist sites and blueberries on dry sites, but laurel was indifferent in that respect. *From authors' summary.*

64 : 12.26–8 : 21.0 : 11.34. AUTEN, J. T. **Prediction of site index for Yellow Poplar from soil and topography.** *J. For.* 43, 1945 (662–8). [Central States Forest Exp. Sta., Columbus, Ohio.] [1441].

A study was made of 77 natural second-growth Yellow Poplar (*Liriodendron tulipifera*) stands, varying in age from 12 to 61 years, in Tennessee, Kentucky, Ohio, Indiana and

Illinois, for the purpose of setting values on soil properties and topographic features as a guide in predicting site quality for Yellow Poplar. The species was shown to require deep, permeable, well drained but moist soil, and shelter from drying wind.

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

66 (43.1–5) : 90 : 60.31. KÖSTLER, J. La conservation du capital en sylviculture dans le cas de coupes excédentaires. [**Conservation of forest capital in the case of excess fellings.**] *Intersylva* 3, 1943 (374–86). [F.g.e.span.f.it.] M.E.W. [1442].

Excess fellings are being undertaken in various countries and it is important to study the use to which the capital thus withdrawn from forestry should be put. By cutting in excess of the planned exploitation, greater or smaller amounts of capital are withdrawn from forest undertakings, the utilization of which must be investigated from the point of view of forest policy for (*a*) the redemption of mostly long-term loans (repayment of mortgages), (*b*) the establishment of cash reserves, and (*c*) the accumulation of capital reserves for investment at a later date for the intensification of exploitation and for re-afforestation. The question is less one of monetary capital than of actual forest capital, and it is therefore logical to take into account the future yield capacity. For this purpose, the effects of excess felling as well as the possibilities of conserving and improving the actual forest capital should be considered, and the following points should be examined: (*a*) execution of excess fellings with leniency to the forest (choice of place and manner of felling), (*b*) greater care for the regeneration and early tending of stands in order to increase their yield, and (*c*) expansion of the basis of production through afforestation. In the field of forest policy, the following practical measures may be advised: guarantees that withdrawn capital will be used for forestry purposes, redemption of loans, establishment of reserve funds, prevention of detrimental effects on timber prices and forest taxation.

66 : 57 : 32.2 (71.5). HENDERSON, W. M., BROWN, E. L., and MACKAY, M. **A determination of yield on the University of New Brunswick woodlot.** *For. Chron.* 21, 1945 (196–204). [University of New Brunswick.] [1443].

The purpose of this study was to predict the volume per acre which can safely be cut each year. The intention is to have the volume cut fully replaced by new growth over the thirty-year period which has been adopted as the cutting cycle. In addition, it was decided to determine the size of the trees which should make up this volume. Tables are given showing the volumes per acre which are recommended to be removed in each cutting cycle for the 4 species Spruce, Fir, Hemlock and White Pine, and the method of deducing annual cut from the information in these tables is explained.

66 : 65.6 : 55. BEHRE, C. E. **Growing stock, cutting age, and sustained yield.** With comment by A. E. Wackerman and rejoinder by C. E. Behre. *J. For.* 43, 1945 (477–85). [U.S. Forest Service, Washington, D.C.] [1444].

Understanding of the forest situation in the United States requires an appraisal of present stand in relation to the volume of growing stock needed to sustain prospective timber requirements. This paper points out that for a given level of output the required growing stock is a function of cutting age and may be expressed as a multiple of the yield. Growing-stock ratios, deduced from available yield tables and assumptions as to average cutting ages are given for Ponderosa Pine, Douglas Fir, Sitka Spruce, Hemlock, Western White Pine, Longleaf Pine, Shortleaf Pine, Loblolly Pine, Slash Pine, Eastern White Pine, Jack Pine, Red Pine, Red Spruce, Eastern Hemlock, Northern hardwoods, Appalachian hardwoods, Oak and Red Gum. Other tables show adequacy of present total timber stands and of present sawtimber stand. Growing-stock ratios indicate that the present, poorly distributed volume of standing timber is not greater than the well distributed volume of growing stock necessary to maintain the current level of output, let alone to ensure a larger potential yield. The author's calculations indicate that, contrary to popular opinion, the growing-stock deficit in the East is most serious in Southern Pine.

In his comment, Professor Wackerman argues that a 60-year rotation is longer than is necessary for Southern Pine, and that substitution of 50 or 40 years greatly reduces the apparent deficiency.

56 : 12.25. MILES, C. **Cutting cycles in Ponderosa Pine.** *J. For.* 43, 1945 (508–9). [U.S. Forest Service, Ogden, Utah.] [1445].

It has been shown in earlier papers that in the southwest United States, net increment in Ponderosa Pine stands increases during the first 10 years after cutting and then begins to decline [cf. *For. Abstr.* 6 (201, 264)]. In this article, the author presents data from sample plots on the Boise and Salmon National Forests, which show an initial period of rapid growth after heavy cutting, followed by a decline of relatively short duration, and then a decided upward trend. On the basis of this evidence, it is concluded that the facts now available do not warrant a cutting cycle of less than 30 years for Ponderosa Pine in southwestern Idaho.

66 (77.5) : 32.1. MARTIN, R. **Timber marking for second-cycle cutting in Northern Wisconsin.** *J. For.* 43, 1945 (655–7). [1446].

The author writes about a Hemlock/hardwood forest, managed on a sustained-yield plan since 1927. The first cutting cycle was completed in 1944 and the percentage of timber removed varied from 35 to 55 per cent. of the merchantable volume. The remaining forest now consists of trees of medium or small size and vigorous growth. In the second cutting cycle just commenced, the percentage of the volume cut will be light, from 10 to 20 per cent., and the length of the cutting cycle reduced to 5 years. The article reviews the general principles involved in marking a forest of this kind.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

74. VALUE OF THE STAND. VALUE OF THE FOREST

74 : 95.1 (485). NORDQUIST, M. Några synpunkter på 1945 års allmänna fastighetstaxering av skog. [**Some points of view on the 1945 valuation of forest estates.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (165–77). [Sw.] [1447].

The main changes in forest valuation for taxation purposes are that, for assessing stumpage values, the 5-year period has been replaced by one of 10 years (to reduce the effect of fluctuating timber prices), the allowance for general costs has been lowered from 33 to 30 per cent., and some further modification has been made in differential allowances for increment on the same nominal site qualities in different regions.

74.2 : 12.26–8. ROTHERY, J. E. **Some aspects of appraising standing timber.** *J. For.* 43, 1945 (490–8). [Division of Timber Management, U.S. Forest Service, Washington, D.C.] [1448].

The discussion in this article is confined to a single phase of appraisal, i.e. the market value of standing timber for sale on a pay-as-cut basis. The four principal methods by which market value is estimated are:—

(1) A percentage of the selling price of the product.

(2) The residual remaining from the selling price of the product after deducting the logging and manufacturing costs, plus a certain percentage of these costs, or an 'overturn' margin for profit and loss.

(3) A sum determined by direct or over-all comparison with prices established in generally similar transactions.

(4) The residual remaining after deducting from the estimated gross return available for stumpage, risk and interest (the 'conversion return'), an allowance on the investment in plant, facilities, equipment and working capital sufficient to induce an operator to undertake the risks involved.

The economic and practical weakness of methods (1) and (2) are pointed out, and a combination of methods (3) and (4) is discussed in detail. This consists in apportioning the conversion return between stumpage to the owner, and risk and interest to the operator, as a study of comparable transactions indicates to be reasonable in the circumstances. Examples of the working of the method are given.

76. MANAGEMENT STATISTICS

76.1 : 32.91.22. MATTHEWS, D. M. **Machine rates, production schedules and cost schedules.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 770 (B–8–e), 1945. pp. [4]. [1449].

Adequate control of the factors which affect the cost of a production method is often more to be desired than the design of a new method, and this paper is a plea for more careful

analysis of cost and control of production through advance planning. The possibilities in this direction are illustrated by a discussion of what can be done in the field of truck hauling, taking into consideration such factors as machine rate for the type of truck being used, load carried, fixed time per trip, variable time per trip, topography, weather conditions, and efficiency of drivers. Formulas are worked out for calculating daily production per truck in cords, trucking cost per cord, the number of volume units required to warrant road construction to the highest standard, hauling cost per 100 cords per mile.

8. FOREST ADMINISTRATION

81. ORGANIZATION. REGULATION OF SERVICE

81 (729). Stockdale, Sir, F. **Development and welfare in the West Indies, 1943–44.** H.M. Stationery Office, London. 1945. pp. 115. Colonial No. 189. [1450].

Forestry services are provided in British Guiana, British Honduras, Trinidad and Jamaica, and the proposals that forestry work in the Windward and Leeward Islands should be placed under the direction of the Conservator of Forests for Trinidad and Tobago were approved and put into effect (p. 33).

82. LABOUR QUESTIONS

82 : 32.2. Hilf, H. H. Die Leistungszahl. Ein Massstab für den Leistungsvergleich ganzer Einschlagbetriebe. **[The labour efficiency factor. A measure of comparative performance in complete felling operations.]** *Forstarchiv* 20, 1944 (129–40). [G.] [1451].

The measure of comparative performance in cutting operations which has usually been employed is that of simple production in cu.m. per day which gives a completely misleading picture, since it neglects the varying felling times and difficulties of working for different species and sizes of tree. Possible measures of efficiency are (*a*) average earnings; (*b*) average output—cu.m. per hour or cu.m. per day; (*c*) average expenditure of time. It is the last of these measures which is expounded in this article. In order to establish a comparison of efficiency on this basis the following measures are necessary:—(*a*) the organization of the felling operations; (*b*) the calculation of theoretical working times for various species and types of tree; (*c*) classification of the work according to site and difficulties of working; (*d*) calculation of theoretical time for the work in question; (*e*) calculation of actual time taken.

Tables are given of theoretical felling times for the principal utilization categories of wood; a classification of the principal utilization categories of wood into 12 difficulty classes, based on felling time; a classification of sites according to difficulty of working. Examples are given of calculations of comparative efficiency made on these principles.

82 (485) : 32.25. Luthman, G., and Olsson, P. O. Rationaliseringssträvanden inom det värmländska skogsbruket. **[Efforts towards the rationalization of forestry in Värmland.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (195–259). [Sw.] [1452].

A general account of the studies in Värmland [cf. *For. Abstr.* 5 (81–3)] on the rationalization of logging operations. The major sections discuss tools, the technique of work in felling and related operations, amenities such as rest cabins and improved clothes for the workers, administrative organization of work, the introduction of new tools, etc., and education of supervisors and workers.

82 : 91.8 (43.1–5). Strehlke, E. G. Reichseinheitliche Leistungslöhne in der Forstwirtschaft. **[Uniform wages for forestry work throughout the Reich.]** *Forstarchiv* 20, 1944 (141–8). [G.] [1453].

At the time of writing (1944), the author had just completed 1½ years' work on a draft scheme for a uniform rate of wages for woodcutters throughout the German Reich with the exception of high mountain areas, which was about to be put into experimental operation in several forest districts. Forest wages varied widely from district to district, and after 1939 the discrepancies became even greater. National, uniform wages must be based on full work by an able-bodied, trained, well equipped forest worker in a properly organized crew. The methods used in constructing the proposed system of tariffs are described in some detail. The proposed piece-rates are divided into five groups of tariffs based on the volume of mean stems of various types of stand, and the consequent felling time needed to produce a given quantity (1 cu.m. in bark in the case of

timber, 100 pieces in the case of poles, 1 stacked cu.m. in the case of cordwood) of wood. A table is given showing this information for various species (hardwoods excepting Alder, Spruce, Fir, Pine, Larch) and utilization categories (long logs, pitprops, small poles, various types of construction timbers, firewood, pulpwood, etc.) in the 5 volume classes (up to 0·10 cu.m., 0·11–0·20 cu.m., 0·21–0·50 cu.m., 0·51–1·00 cu.m., and above 1·00 cu.m. volume of mean stem).

82 (43.1–5). BERGKNECHT, F. Erfahrungen mit Leistungslöhnen auf Grund von Zeitstudien. **[Experiences with wages on the basis of time studies.]** *Forstarchiv* 20, 1944 (148–52). [G.] [1454].

The time studies on which the writer based the wage rates whose application he describes were made in 1920 and 1924–5 in the forest of Schlangengrübe/Rosslau in difficult conditions (Dauerwald Pine forest with already well advanced regeneration) and during the inflation period. He describes his introduction of these wage rates, first in the Ducal Forest of Anstalt and later, in 1935, in the Ducal Forest district of Rabenstein in the Potsdam forest division. The effect of their application in increasing both output and wages in the second case, is shown in the following table:—

1935 total output per hour	0·24 cu.m.	
1940 „ „ „ „	0·40 cu.m.	
increase	0·16 cu.m.	= 67 per cent.
1935 mean earnings per hour	0·50 RM	
1940 „ „ „	0·80 RM	
increase	0·30 RM	= 60 per cent.

82 (43.1–5). STREHLKE, E. F. Wege zur Erfüllung der kriegsnotwendigen Waldarbeiten durch Leistungssteigerung. **[Ways of accomplishing forest work needed for the war, through increased efficiency.]** *Forstarchiv* 20, 1944 (157–60). [G.] [1455].

Advice of a general nature on the organization of a forestry labour force, with suggestions of tasks which could be performed by women and children in their spare time, the employment of aged forest workers, and the establishment and running of forest camps of prisoners of war and foreign workers.

82 (485) : 07.1. HEIDEKEN, F. VON. Skogsarbetareutbildning i folkskolans fortsättningsskola. Redogörelse för ett försök i Råneå s:n, Norrbottens län. **[Training of forest workers in the extension branch of the national school: report on an experiment in Råneå parish, Norrbotten.]** *Skogen* 32, 1945 (291–3). [Sw.] [1456].

This trial course, planned by Munksunds A.-B. with the aid of representatives of the State Forest Service, the County Forestry Board, and other interested bodies, was designed for youths and lasted from 2 Sept. to 31 Oct., 1944. It was so successful that another, lasting 2½ months, is now planned. The syllabus will be: general knowledge of Sweden's forests 15 hours; marking and other silvicultural operations 46 hours; timber cutting 115 hours; cutting of cordwood 35 hours; transport 35 hours; scaling 20 hours; care of tools 34 hours; sowing and planting 8 hours; fire control 5 hours; hunting and fishing 10 hours; calculation and writing 10 hours; hygiene, first aid, etc., 14 hours; forestry in relation to the community 1 hour; and various excursions 12 hours (total, 360 hours).

82 (71.4). COOK, A. S. **Accident prevention.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 759 (B–2), 1945. pp. [3]. [1457].

The accident experience rate in Quebec has come down from 7 per cent. in 1936 to 2½ per cent. in 1943. Where there was formerly one accident for every 800 days worked, the frequency is now one to 1,950 days. Much might still be done to reduce accidents still further, and it is suggested that the first-aid men employed by many insurance companies might also act as safety inspectors, and that more detailed studies on the spot should be made of serious accidents.

9. FOREST POLICY

9 : 06 : 07. **Third report to the Governments of the United Nations by the Interim Commission on Food and Agriculture, transmitting the report of the Technical Committee on Forestry and Primary Forest Products.** Washington. April 25, 1945. pp. 47. [1458].

The constitution of the Food and Agriculture Organization of the United Nations provides for the inclusion of forestry and primary forest products among the functions of the FAO. Since forestry was not discussed at the Hot Springs Conference, the Interim Commission decided to submit to governments a further report on forestry. A Technical Committee on Forestry and Primary Forest Products was accordingly set up in March, 1944, to consider the work of FAO in this field, and reported in November, 1944. After an introductory survey of the position of forests in world economy, Section 1 gives a review of the work of previous international forestry organizations. Section 2 outlines the task of FAO in this field. The functions of FAO will be (1) research, (2) dissemination of knowledge, (3) advisory functions, (4) administrative functions.

(1) Working relations should be established with professional and industrial institutions (private, national and international), some of which have developed remarkably good statistical and information services. FAO will be expected to interpret the primary material flowing in from all sides, to correlate the facts and find out what they mean. Regular international forestry statistics have so far been almost wholly confined to international trade in forest products. The committee has worked out suggestions for a statistical programme with regard to forestry and forest products, but before any such programme can be effectively carried out, countries will have to be induced to improve and expand their national forestry statistics and adjust their definitions and units of measurement to the requirements of international comparability. Possibly a useful start could be made by organizing as soon as possible (1950, for instance) a world forest census to be repeated at ten-year intervals, and to be kept up to date between survey years by FAO on the basis of national reports.

FAO should lose no time in promoting interest in research among the governments and industries of all countries and in establishing permanent contacts among all research workers and agencies, private and public, interested in forestry and forest products. It should also stimulate and co-ordinate research on specific problems, and facilitate exchange of scientific personnel between forest experiment and research stations of different countries.

(2) It is advisable that FAO forestry publications should include at least (*a*) a statistical yearbook, supplemented by a monthly or quarterly bulletin, and (*b*) a monthly or quarterly world review of forestry and forest products. FAO should also see to it that world-wide abstracting services dealing with all aspects and phases of forestry and forest products are available. It could also render valuable services in advising national authorities on matters of technical education, providing material for the education of the public, and establishing a complete modern library of forestry and forest products.

(3) and (4) The advisory and administrative functions of FAO will inevitably be assumed more gradually, but possible lines of advance are sketched out. It is recommended that the FAO organization should, at the earliest possible moment, enter into negotiations to absorb the Centre International de Sylviculture, the Comité International du Bois, the International Union of Forest Research Organizations, the Forestry section of the International Institute of Agriculture and the Institute's activities in the field of forestry statistics.

Summarized proposals are given for the proposed administrative organization and there is a useful classification of the products falling under the terms 'primary forest products'.

9 : 06.2. [Five technical reports on food and agriculture.] **Forestry and primary forest products.** With appendices. United Nations Interim Commission on Food and Agriculture, Washington. 1945 (217–59). [1459].

Five Technical Committees have studied problems of (1) nutrition and food management, (2) agricultural production, (3) fisheries, (4) forestry and primary forest products, and (5) statistics; their reports, completed in April 1945, have been transmitted to the United Nations Interim Commission on Food

and Agriculture (FAO). Extensive recommendations are made by each Committee as to the functions of FAO as an international agency for (*a*) the survey, analysis and dissemination of information on existing conditions and potentialities, (*b*) scientific, technological and economic research, and (*c*) international co-operation in each field; specific recommendations are made for those activities considered to be the most urgent at the outset.

The report of the Committee on Forestry and Primary Forest Products is based on more recent factual material and documentary evidence than was utilized in its first report (cf. previous abstract), and divides its survey into the following sections with recommendations for each:—inventory of forest resources, promotion of scientific progress, forest protection and silviculture, forest management, co-ordination of forestry and agriculture, economic and social problems, forest credit and co-operatives, international forestry statistics, policy, administration, technical forestry education, properties of wood, wood utilization, extraction of raw materials, forest products in general, lumber, pulp, veneer and plywood, other primary forest products, and international trade.

Its recommendations for immediate activities are classified in two groups—projects to be started at once, and those to await opportunities and staff facilities. The first group comprises (i) Rehabilitation problems of which the three most significant are (*a*) an assessment of lumber requirements for the 5-year reconstruction period and comparison with lumber supplies and the existing pulp capacity in various regions, followed by an appraisal of pulp requirements by major categories of products; and (*c*) an investigation of the effect of war on forests with special emphasis on the productive capacity of forests in sawlogs, veneer logs, mine props, pulpwood, etc., beginning with Europe, the Soviet Union and North America. (ii) Regular statistical services and publications, which are discussed more fully in the introductory article of this number of *Forestry Abstracts*. (iii) International studies of (*a*) the recent progress in forest management, taking up both technical issues and public policies, as also training facilities and an estimate of the number of trained foresters needed and available; (*b*) sciences related to forestry; and (*c*) new methods of wood utilization. (iv) A first world forest census.

In the second group the Committee recommends:—(i) A survey of afforestation projects with special attention to their potential contribution to national policies for full employment. (ii) The survey and development of inaccessible forests. (iii) Seed certification. (iv) Wood balance sheets. (v) Implications of excessive cuttings. (vi) Living standards and wood consumption. (vii) Long-range pulp consumption and pulpwood supplies. (viii) The third world forest congress to be convened by FAO at the end of its initial period of organization.

90. GENERAL PRINCIPLES OF FOREST POLICY

90 (410). **Forestry and agriculture.** *Nature, Lond.* 155, 1945 (311–2). [1460].

A discussion of the relations between forestry and agriculture, arising out of the decision to make the Minister of Agriculture and Fisheries and the Secretary of State for Scotland jointly responsible for forestry policy and its execution, with the Forestry Commission as an advisory body having executive functions. It is suggested that, while research on special problems, particularly those of a highly technical nature, continues to be done under the auspices of the Forestry Commission, research of a more fundamental nature could perhaps more appropriately be taken over by the Agricultural Research Council. There is a vast field for research into primary forest soils, tree physiology and forest ecology, which has hitherto been much neglected.

90 (410). STEBBING, E. P. **The Forestry Commission: the first twenty-five years.** *Nature, Lond.* 155, 1945 (317–8). [1461].

A review of the work of the Forestry Commission since it was set up in 1919. In that period the Commission has acquired about $1\frac{1}{4}$ million acres, of which $\frac{1}{2}$ million acres have been afforested and $\frac{1}{4}$ million acres remain to be planted. The rest of the land is either unproductive, above the present plantable altitude, or agricultural land. This acreage is spread over 263 forests, of which 102 are in England, 39 in Wales, and 122 in Scotland. 1,500 forest holdings, each consisting of a house and an acre or so of land, have been established for permanent forest workers.

The areas planted in England and Wales were 276,898 acres of unafforested land and

49,102 acres of acquired woodland (The New Forest, Forest of Dean, etc.). The chief species planted were Scots and Corsican Pine, European and Japanese Larch, Norway and Sitka Spruce, Douglas Fir, Oak and Beech. The area planted in Scotland amounted to 163,000 acres, the species used being Norway and Sitka Spruce about 53 per cent., Scots and Corsican Pines about 26 per cent., European and Japanese Larches about 11 per cent., other species 10 per cent.

A brief account is given of the research work done in connexion with this planting programme, particularly experiments in the planting of deep peat soils, in which considerable success has followed the use of deep tractor ploughing.

90 (41.5) : 09.1. PETRIE, S. M. **Nisbet's observations on Irish forestry in year 1904.** *Irish For.* 2 (1), 1945 (12–8). [1462].

A detailed account of Dr. Nisbet's 'Report on the Woods, Plantations, and Wastelands in the South-Eastern Counties of Ireland', which was addressed to the Department of Agriculture in 1904. The main findings of the report are as follows:—

(1) Only one-fifth to one-quarter of the existing woods in the south-east counties of Ireland were originally formed with the intention of working for profit.

(2) Owing to heavy thinning, growing stock was much poorer in volume and quality and much more liable to damage from wind than it should have been.

(3) The market for home-grown timber was very poor, the chief market being for Larch for export to England and Wales.

(4) Crops of conifers were most likely to prove profitable and best suited to soil and climate.

(5) About 755,928 acres of waste land in Ireland seemed plantable with a chance of direct monetary profit.

(6) Mixed plantations of conifers, made at an average cost of £7 per acre, should be profitable in the future.

(7) Formation of woods and shelterbelts would be of great benefit to grasslands and stock-raising.

(8) Plantations should be in large blocks, preferably not less than 1,000 acres and shelterbelts should be raised five years before the main planting.

(9) There was little likelihood of an increase in the woodland area unless the State accepted the duty of planting and a Forestry Branch of the Department of Agriculture should be set up.

(10) Before any great national scheme of planting could be undertaken it would be necessary to provide technical education for practical foresters and, to improve the management of private woods, a course of instruction should be arranged for estate agents, stewards and foresters.

90 (41.5) : 33.0. ANDERSON, M. L. **The importance of forestry in national planning.** *Irish For.* 2, 1945 (57–61). [1463].

A general outline is given of the growing importance of wood as a raw material and it is emphasized that, even if the often predicted world timber famine does not occur, the heavy, world-wide demand for forest produce must greatly enhance the value of the forest and, from a national point of view, alter the former relationship of forestry and the other land-using industries to the advantage of forestry. From a forestry point of view it is unfortunate that over one-third of the population of Eire lives in 10 seaport towns, to which the transport of a bulky commodity such as timber is much easier by sea than overland.

90 (54). STEBBING, E. P. **Post-war forest policy in India.** *Nature, Lond.* 156, 1945 (286–8). [1464].

A detailed review of 'A Note on Post-war Forest Policy for India' by the Inspector General of Forests, 1944. [Cf. *For. Abstr.* 6 (267).]

90 (54) : 98.1 : 11.62.11 : 97.2–3. HABEEB KHAN, M. **Need for planned forest policy.** *Indian For.* 71, 1945 (221–8). [Forest Research Division, Srinagar, Kashmir.] [1465].

The article gives a résumé of the most pressing problems facing Indian forestry in the post-war period. The first of these is a revision of working plans in consequence of the excess and advance fellings which have been made during the war; most of the normal cultural and regeneration operations have been in abeyance, and regeneration in the felled areas will be much in arrears. Revised estimates of future yields and the extent of reduction in the annual possibility from each working circle and felling series must be carefully worked out. A second problem is presented by the probable shortage of constructional and some other

timbers, and reconnaissance surveys should be undertaken immediately to map out and estimate the approximate yield capacity of forests of auxiliary species so that they may be exploited along with the main species. Wartime prices are bound to fall, and this factor, combined with reduced yields, will bring about a substantial reduction in forest revenues; this can be offset to some extent by fuller exploitation of minor forest products, expansion of pulp, plywood and match manufacture, and research into uses for species not hitherto utilized. Deterioration of the land following denudation of hillsides, and consequent erosion, are problems of long standing which have been tackled, if at all, in a piecemeal fashion. They should be classed and dealt with as a national emergency, and both provinces and states should be made to align themselves with an all-India policy. It is emphasized that the co-operation of even politically insignificant states is essential, since they may contain the headwaters of important rivers. Indian agriculture suffers from the handicap of non-availability of farmyard manure, which is burnt as fuel in many villages, and provision of fuel forests within easy reach of the villages, or of fuel at nominal prices, is the proper way of releasing cowdung for the fields, and the onus of meeting this want lies on the Forest Department. The incidence of grazing in forests is far too heavy; it injures the forests and encourages the maintenance of poor-quality cattle. Data should be collected to assess the area of the grazing lands and the grazing that they can bear, and means should be devised to regulate grazing and improve the pasturage. Finally, it is urged that forestry should not continue to be treated as an unavoidable adjunct to agriculture, but should be given an important and independent position.

90 (54.7) : 09.7 : 23.22.2. PETTY, J. **Development of forests and woodlands in Sind.** *Indian For.* 71, 1945 (210–7, 252–64). [1466].

Part I of this report by the Conservator of Forests gives a brief description of the Province of Sind, its past history and the development of forest growth, especially on irrigated areas.

The reserved forests cover about 1,100 sq. miles, which is just over 2 per cent. of the area of the province. The total percentage of forest to cultivated or cultivable area is 6 per cent. compared with an average forest area of 14 per cent. in other provinces of India. The average pre-war annual surplus of Rs. 4 lakhs rose during the war to Rs. 28 lakhs.

Part II describes the objectives aimed at. These are: balanced rural economy, protection of desert, afforestation of hills, provision of amenities such as roadside avenues and green belts, and expansion and development of forests so that their annual yield should be 50 or 60 million cu. ft., which is three times the pre-war yield.

Part III consists of recommendations for new afforestation and improvement of the existing estate, in the rural areas, the desert, the hill areas and the riverain forest proper. When the new barrages are complete, about 1½ million acres of land will have to be reserved for irrigated plantations. These new forests should preferably be in belts or strips along the canals, so that the trees can obtain some of their water requirements by percolation. There should be no fixed rotation; the forests are essentially fuel forests and the size of the billets required for firewood or charcoal must be the guide to the size of trees to be grown. Probably the billets required do not exceed 18 in. to 24 in. in girth, and in the best riverain areas Babul (*Acacia arabica*) will grow to this size in 8–10 years. Perhaps one-tenth or so of every Babul 'cut' might be reserved to produce timber; all other Babul woods should be felled as soon as they reach the 18–24 in. girth limits. Kandi (*Prosopis spicigera*) would probably be considered mature on reaching 18 in. in girth, which will take 12–20 years. As it is useless as timber, no part of any cut of this species should be reserved for timber production. The size of Lai (*Tamarix* sp.) required for firewood (this species does not make good charcoal) probably does not exceed 12 in. to 18 in. girth, which should be reached in 7–10 years. Bahan (*Populus euphratica*) is a poor fuel and should be grown entirely for timber. A tree about 6 ft. in girth can be grown in about 20–25 years. Of the exotics, Mulberry has already proved a success and one species of Willow is growing well. Cuttings of the Cricket-bat Willow should be imported from England. Other exotics recommended are Bamboos for hutting and *Acacia mollissima* and *A. decurrens* for the provision of tanbark. Subjects on which research is urgently required are the rate of growth of desert flora; the number of acres of desert required to maintain

one animal; the minimum quantity of water which will yield an outturn of 100 cu. ft. of wood an acre a year; the best irrigation methods, i.e. what should be the width and depth of the trenches, and whether they should be dug alongside or midway between the tree lines; what modifications of technique are necessary to avoid 'wilt' disease; what better fodder grasses can be established without damage to soil fertility; what timber trees can be produced in irrigated plantations.

Part IV contains proposals for increase in staff and improvements in pay and conditions. Part V discusses capital outlay involved in the proposed developments and gives estimates of future revenue and expenditure. Part VI indicates what can be achieved in the first 5 years after the war.

90 (66.7) : 81 : 12.26–8. MARSHALL, R. C. **Forestry in the Northern Territories of the Gold Coast.** Govt. Printing Department, Accra. 1945. [i] + 13. [1467].

The Northern Territories of the Gold Coast lie roughly between 8° and 11° northern latitude and are thus wholly within the tropics. The total area is 41,063 sq. miles, with a population of over a million. The vegetation is savanna forest of varying density and composition, with close fringing forest along many of the streams and rivers. The protectorate is essentially a forest-and-agricultural community with practically no export money crop. Trypanosomiasis is endemic and the effect of vegetation on the incidence of tsetse flies has to be borne in mind.

The function of forestry falls into two main divisions: indirect utility in the conservation of water supplies, prevention of erosion, shelterbelts, etc., and direct utility in the supply of fuelwood, poles, and possibly the production of limited amounts of sawn timber which now has to be imported from Ashanti. The headwaters of rivers should be maintained under forest. In some cases reafforestation is indicated, but many such areas are now under cultivation. Evergreen shelterbelts oriented in a general N.W.-S.E. direction are needed to reduce the effects of dry winds. They should, wherever possible, be supplemented by rows of trees round farms. Apart from firewood, the main timber requirement is for round building poles used in the construction (particularly of the roofs) of compound houses. A surprising number of poles is used in the construction of flat roofs.

To provide for the above, an extensive system of forest reserves, supplemented by plantations and farm woodlots, is required. Reserves should be selected to protect the headwaters of all major streams. In Navrongo District the sources of 5 major streams were examined. In each case the slopes above the stream had been denuded of practically all vegetation by farming and the grazing of stock. To aid in selecting reserves, aerial surveys and mapping would be most valuable. After the laying out of headwaters reserves has been completed, attention should be directed to linking them up with shelterbelt reserves. It is anticipated that great difficulty will be encountered in the densely populated, heavily farmed areas, i.e. just where shelterbelts would be most desirable.

Silvicultural research on both native and exotic species is essential before large-scale plantation work is embarked on. The silvicultural characters of the following native species at least should be investigated: *Acacia senegal, A. albida, A. arabica, A. campylacantha, A. macrothyrsa, A. seyal, A. mellifera, A. ataxacantha, A. rehmanniana, A. sieberiana, Anogeissus schimperi, Afzelia africana, Burkea africana, Bombax buonopozense, Butyrospermum parkii, Detarium senegalense, Daniellia oliveri, Parkia filicoidea, Pseudocedrela kotschyi, Pterocarpus erinaceus, Khaya senegalensis, Isoberlinia doka, and Tamarindus indica*; and the following exotic species: *Cassia siamea, Dalbergia sissoo, Azadirachta indica, Tectona grandis* and *Eucalyptus* spp. Notes on distribution, habit and utilization of all the above species are given in an appendix. Recommendations are made for a proposed forestry staff to carry out the above proposals.

90 (71). STEINHAMER, S. **What is wrong with Canadian forestry?** *For. Chron.* 21, 1945 (193–5). [Central Pulpwood Association, Winnipeg, Manitoba.] [1468].

The writer recapitulates certain current provincial practices on Crown lands, which are not conducive to sound forestry, such as the classification of forest dues and royalties from logged-over lands as income to general revenue, and expenditure on long-term forest improvements as ordinary expenses. In private industry these would be classified respectively as forest capital and capital investment. Other

weaknesses are lack of continuity in forest management owing to political changes; the largely negative character of provincial forestry regulations; understaffing and underpayment of Forest Services. It is suggested that management of Crown-land forests through provincial commissions would be an improvement on the present system. The benefits would be (1) continuity in management, (2) removal of forestry personnel from political influence, (3) initiation of proper forest financing through establishment of a Forest Fund into which all proceeds from operations would go and from which moneys would be available for expenditures on long-term projects. Balances remaining in the Forest Fund could be lent to the province at regular rates of interest.

Collection of immediate income from the forests has in all provinces brought about a depletion of forest capital in the more accessible regions. The measures needed to bring about higher long-term cash revenues from the forest are:—

(1) Re-investment of the larger part of current proceeds in better protection and road improvements.

(2) Encouragement of operations in more remote areas through a graduation in dues charged for stumpage.

(3) Increase in forestry staff so that no forest officer would have a larger district to supervise than can efficiently be handled; and adequate remuneration.

(4) The Forest Service should be more actively occupied in the promotion of operations and the establishment of new forest industries than is now the case.

90 (71) : 60.31 : 33.32. WILSON, J. O. **Forest management problems associated with pulpwood operations.** *Pulp Paper Mag. Can.* 46, 1945 (702–3, 705, 707, 709, 711–2). [1469].

The purpose of this paper is to provide material for the study and discussion of the many forest-management problems associated with pulpwood operations in Eastern Canada. These are considered briefly with reference to forest management, forest surveys and inventories, working plan units or working circles, forest protection, silviculture, forest research, forest labour, forest land tenure, private lands, forest finance, integration and diversification, mechanization of logging, collective effort within the industry, co-operation with others.

90 (71.1) : 66. MACMILLAN, H. R. **Forests for the future: conditions essential to a sustained-yield policy for management of British Columbia Coast Forests.** H. R. MacMillan Export Company, Ltd., Vancouver, B.C. 1945. pp. 63. [1470].

This discussion is confined to the chief measures that must be adopted before the forest land of British Columbia can be maintained in a reasonably continuous productive condition. It is considered feasible, over the next two generations, to convert the Coast forest to sustained annual yield without reducing the level of forest production and employment dependent thereon, by taking the following action: fire protection to be greatly improved; all productive forest land to be reforested promptly after logging; productive forest land, now barren, to be planted within 15 years at most; the Forest Administration of the Province to be strengthened and forest education improved; utilization to be improved in the woods and in the conversion plant; a closer inventory to be made as soon as possible, particularly for the Coast forest region, which supports the greatest population; such inventories to be revised every 15 or 20 years. The average annual cut in the whole Coast forest region should not exceed the amount that can be sustained until the next rotation is established. This policy will probably allow for a minimum production of 3 billion ft. yearly, rising in volume annually as all productive forest land comes under a growing crop well assorted as to age.

90 (71.6) : 09.4 : 60.31. **Forestry, economy and post-war reconstruction in Nova Scotia.** Nova Scotia Members of the Canadian Society of Forest Engineers. 1944. pp. 61. [1471].

This brief was prepared by eleven Nova Scotia members of the Canadian Society of Forest Engineers for presentation to the Minister of Lands and Forests for the province. The total area of Nova Scotia is 20,743 sq. miles, of which 15,300 sq. miles is estimated to be wild land, at one time nearly all forested. In spite of destructive logging and fires and insect epidemics, 80 per cent. of the forest area is still productive in some degree and the forest-products industry ranks third among the Province's primary industries, with an annual production valued at about 22 million dollars.

Cutting practices are mostly destructive of the productive capacity of the forests, which is declining in quality and productiveness. There has never been a complete and accurate inventory of the forest resources of the Province. Although it is believed that depletion exceeds growth, it cannot be definitely known without an inventory. Waste and loss in present methods of manufacture are very great and savings of at least 22 per cent. in the annual drain on the forests are possible with economical operation. The absence of any systematic grading policy in Eastern Canada has resulted in unstable prices and markets. The Maritime Lumber Bureau has been set up to help overcome these unsatisfactory conditions. Fire protection is still not adequate, and there are considerable losses from insects and disease. Many districts lack adequate roads. Present systems of taxation encourage liquidation of forest properties rather than good management. Unsound land-settlement policies have resulted in numerous poor communities and abandoned farms and destruction of large forest areas by fire from careless brush-burning. The standard of living of forest workers is notoriously low. Although natural regeneration is often satisfactory, many areas are not regenerating and little or no effort has been made at artificial regeneration. Few, if any, towns or other communities maintain forests of their own for production of water supply, etc.

The recommended programme of measures necessary to improve present forest conditions includes education of the public, and technical education of men for forest services and industries. Legislation requiring the practice of good practical forest management should be introduced after a suitable period of education. An inventory of forest resources should be made in as short a period as possible, using aerial photography supplemented by ground work. Immediate introduction into general commercial use of the Spruce grades of the Maritime Lumber Bureau would have many advantages. The fire-protection service should be improved by increases in personnel and equipment and establishment of meteorological stations. To make permanent, sustained-yield forest operation economically possible, permanent improvements in the form of motor roads and stream-driving facilities are essential. Roads should be carefully planned to serve whole catchment areas. It is recommended that several areas of Crown land be selected as experimental and demonstration areas; that an economic commission be appointed to study the problem of forest taxation and make recommendations to improve the position. Careful consideration should be given to land use, and farming should be confined to areas suitable for agriculture in units large enough for satisfactory agricultural communities.

Part III of the brief gives estimated cost in man-days and money of carrying out this programme.

90 (728.2 : 729.2 : 729.9 : 88.1). **West India Royal Commission Report.** With appendices. H.M. Stationery Office, London. Cmd. 6607, 1945. pp. 480 + plates + maps. [1472].

The commission sat in 1938–9, and its report, now published in full, was presented to Parliament in 1940.

Forestry is of no commercial importance in Jamaica, the Leeward Islands and the Windward Islands, in all of which, however, it should receive skilful attention if only because of its connexion with water supplies and soil erosion. In those high areas where no form of agriculture could be profitable, the bush should be strictly protected from shifting cultivation and burning, and when the soil has regained sufficient fertility, it should be reafforested and then permanently reserved. Powers given by existing legislation for the protection of forests should be more rigidly used. In the Leeward and Windward Islands, property boundaries should be demarcated, the Ordinance affecting forestry should be revised, and a larger staff and more effective action are needed to effect control.

In British Honduras, the most important problem is that of safeguarding the future of Mahogany, which, at present rates of cutting and regeneration, is a steadily disappearing resource. The three plain needs are better forest protection, the reconstitution of Mahogany areas, and amplification of the forest survey, possibly with the aid of aerial photography. The definition of a clear forest policy for this Colony is an urgent necessity.

In British Guiana, valuation surveys covering 1,800 sq. miles have already been completed. The principal needs in this Colony are continued survey and valuation, more extensive and protected regeneration of Greenheart (*Nectandra rodioei*) which is the chief commercial species, the expansion of markets for

Greenheart and an outlet for sawn timber. It is held that, if wider markets could be found, Greenheart could be exploited on an increased scale at a low cost, including that of proper attention to regeneration.

A well defined forest policy has been laid down by the Government of Trinidad. Mora, the most valuable species in this island, frequently occurs in dense stands, and the present degree of utilization nowhere approaches the limits of permissible production. The Colony is practically self-supporting in hardwoods, but the importation of softwoods, several species of which are available in the island, will be necessary for some years to come. The dominating problem is to find an outlet for the forest products of the Colony, which are certain to show a marked upward trend as the programme of forestry development progresses.

90 (728.2 : 729 : 88.1) : 97.1 : 60. ENGLEDOW, F. L. **West India Royal Commission. Report on agriculture, fisheries, forestry and veterinary matters.** H.M. Stationery Office, London. Cmd. 6608, 1945. pp. 235. [1473].

This report is supplementary to that of the West India Royal Commission [see previous abstract], the findings of which are confirmed and illustrated in rather more detail. Of land not in agriculture much is forest. For instance, in Dominica 65 per cent. of Crown land is forest; British Honduras and British Guiana are almost entirely forest; even in Trinidad over 40 per cent. of the total land area is tree-covered. The writer is convinced that practically the whole of the remaining forest in all the West Indian Colonies is unavailable for agriculture, and this for two reasons. The forest that still remains on hillsides must be rigorously maintained to avoid erosion. Other forest, including the big stretches in British Guiana and British Honduras, is on land so poor or wet or otherwise defective that it could never support anything but forest.

90 (728.2 : 729 : 88.1). WEST INDIA. **West India Royal Commission, 1938–39. Statement of action taken on the recommendations.** H.M. Stationery Office, London. Cmd. 6656, 1945. pp. 108. [1474].

A statement by the Secretary of State for the Colonies, presented to Parliament in June 1945, on the action taken on the recommendations of the West India Royal Commission, 1938–9 [see preceding abstracts]. The Report recommended expert investigation of the arrangement for promoting soundness and continuity of forest policy in British Guiana, British Honduras, and Trinidad, and for assisting the Governments of those Colonies to find local and overseas markets for their forest products. Forest policies have been drawn up for all three colonies and will be put into operation as soon as staff and funds are available. As a result of the war, demand for forest products has exceeded all possibility of supply with existing equipment.

90 (729.9) : 09.7 : 12.19.2 : 33.38. LEEWARD ISLANDS. **Forestry in the Leeward Islands: Barbuda. Report by the Conservator of Forests, Trinidad and Tobago, after preliminary visit by J. S. Beard, Assistant Conservator.** *Bull. Devel. Welfare W. Indies* No. 7B, 1945. pp. 13. [1475].

This is a supplement to the report on Antigua [see *For. Abstr.* 6 (121)].

The island of Barbuda lies about 25 miles north of Antigua and has a land area of some 50 sq. miles. The vegetation differs markedly from that of the other Leeward Islands, most of the island being covered with a low woodland, 10–30 ft. high, consisting of a dense growth of small gnarled trees and bushes with hard, evergreen leaves. Few of them are thorny and the genus *Acacia* is represented by only one species (*A. tortuosa*). Leaf reduction and nanism are pronounced features. It is recommended that areas unsuitable for agriculture should be permanently reserved as woodland and managed on a rotational system for the production of charcoal, small quantities of which are already manufactured for local use. The education of the public and the introduction of suitable legislation are necessary to this end. A list of local and botanical names of indigenous species is given in an appendix.

90 (73) : 60.31.2 : 94.3. KORSTIAN, C. F. **Forestry on private lands in the United States.** *Bull. Duke Univ. Sch. For.* No. 8, 1944. pp. 234 + plates. [1476].

The study on which this report is based was undertaken in 1942 at the invitation of the National Lumber Manufacturers' Association. A recent survey by state foresters indicates that of 345 million acres of privately owned forest land in 37 states, 29 million acres are being handled under forest-management plans to

provide a sustained supply of raw material for manufacturing plants maintained by forest-products industries, and another 72 million acres for the continuous production of forest crops, but which may not sustain existing plants. Of the balance, only 37 million acres are in non-productive condition, leaving 207 million acres re-stocked or in condition to re-stock and become productive. The situation with regard to forest land owned or operated by industry is estimated to be somewhat better. Of 153 million acres of industrial lands, over 25 million acres are under planned forest management; another 45 million acres are being operated for continuous forest production; and all but 9 million acres are in productive condition.

Detailed consideration is given to conditions in eight states representative of four important timber regions: the North-east (particularly New York State), the Lake States (particularly Michigan and Wisconsin), the South (particularly Virginia, Alabama and Arkansas), and the Pacific North-west (Washington and Oregon). Remedial measures are summarized and discussed for all eight states and the entire U.S. It is emphasized that the most important single measure is adequate fire protection. Other important measures are the establishment or extension of co-operative enterprises and their co-ordination, equitable forest taxation, forest credits and either federal or state control of cutting practices. The appendices include drafts of model bills for state control of cutting on private lands.

90 (74.8). **A forest program for Pennsylvania.** *For. Leaves* 35 (2), 1945 (1–2, 15–6). [Pennsylvania Forestry Association, Philadelphia, Pa.] [1477].

According to the most recent estimates, Pennsylvania has 15,127,640 acres of forest land, or 52 per cent. of its total land area. Of the total forest area, 10 per cent. is estimated to contain sawtimber in stands averaging 2,000 bd. ft. per acre and more; 44 per cent. cordwood; 23 per cent. young growth; and 23 per cent. is poorly stocked or non-restocking. 500,000 acres are in federal ownership; 2,485,000 in state, county, and municipal ownership; 2,936,000 in farm ownership; and the remainder in other private ownership. During the past ten years, fires have burned over considerably less than 1 per cent. of the total forest area. The total volume of timber standing in Pennsylvania's forests is estimated at about 5 billion bd. ft. and 70 million cords in pole-sized timber. Total annual growth is estimated at 226 million bd. ft. and 5 million cords. The total drain is 602 million bd. ft. and 2 million cords.

The Pennsylvania Forest Association recommends the following measures to ensure the future of the forests.

(1) An end should be put to the clear cutting of immature timber. (2) A comprehensive inventory should be made of the land resources of the State. (3) Effective control of forest fires. (4) Additional public forests. (5) Public aid for owners of small forest properties. (6) Sustained-yield forestry for each important forest community and industry. (7) The full utilization of forest products. (8) More effective soil and water conservation. (9) Development of forest recreation. (10) Development of a separate State School of Forestry. (11) Civil Service Status for the Department of Forests and Waters.

90 (94 : 944). SWAIN, E. H. F. **Forestry and the conservation imperative in Australian reconstruction.** N.S.W. Forestry Commission: Rural Reconstruction Commission. [1945?] pp. 24 + 14 + 8 + tbls. [1478].

The brief presented to the Commonwealth Reconstruction Commission by the New South Wales Forestry Commission consists mainly of a general survey of the history of forestry in Australia. The appendixes give some account of the N.S.W. Forestry Commission's post-war programme, which includes the establishment of forest training camps and the making of surveys; urgent needs in the latter category are a management survey of 2 million acres of good quality State Forest, a utilization survey of 4 million acres of State Forest not at present within economic range, and a forest classification survey of some 6 million acres of Crown Lands to determine their suitability for forest management. Nearly 8,000 miles of forest road are planned for early construction. The necessary expansion of forest-fire protection is expected to take several years. The silvicultural programme aims at the rehabilitation of more than 2 million acres within the first 20 years after the war. Research will be extended under the control of a Silvicultural Research Officer, who will direct the establishment of

sample plots and silvical studies throughout the State's forest types. The programme for Hoop Pine (*Araucaria cunninghamii*) establishment aims at the planting of 2,000 acres per year for the first 5 years. State plantations of exotic Pines cover an area of 39,000 acres, and the first 5 years' programme of post-war planting aims at a further 8,600 acres a year of *Pinus radiata*, *P. taeda* and *P. caribaea*.

Expenditure on land resumption and redemption is expected to show a steady increase. Among the proposals for reforestation are (*a*) the mile-wide afforested belt from north to south across the State, intended not only for tourist amenity and windbreak purposes, but also as a permanent source of supply for firewood and fencing timber to the treeless plains, and (*b*) the intensification of communal and farm-woodlot plantings including widespread planting of shade and fodder trees such as the native Kurrajong (*Brachychiton populneum*).

90 (96.9). HAWAII. **Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii for the biennial period ended December 31, 1944.** Board of Agriculture and Forestry, Territory of Hawaii. 1945. pp. 115. [1479].

Forestry in the Territory of Hawaii has nearly always been viewed in the light of watershed protection or erosion control. Little serious consideration has been given to development of waste lands as woodlots. The thousands of bd. ft. taken by the Army from Hawaiian forests since the war has shown the economic value of such plantings and brought home realization that quality of timber is as essential as vigour of growth in selecting species for future plantings in areas not primarily catchment areas. It is hoped that both private and government agencies will in future put more waste land under timber trees (p. 20). [Cf. *For. Abstr.* 7 (No. 1144).]

91. SOCIAL AND ECONOMIC SIGNIFICANCE OF THE FOREST

91 (73) : 60.31. WATTS, L. F. **Some federal functions in wildlife and forest management.** *Trans. 9th N. Amer. Wildlife Conf.* 1944 (6–12). [U.S. Forest Service, Washington, D.C.] L.S. [1480].

A discussion on the rôle of the United States Forest Service in the management of wildlife in the 178 million acres of national forests, in forest rehabilitation and improvement, and in the maintenance of sustained timber production.

One of the aims of the Forest Service is to maintain in the national forests a rich and varied fauna, and measures have been taken to control surplus populations which are harmful to wildlife ranges and lead to losses by starvation. Forest projects are ideally suited for supplying post-war employment, because they are in no sense 'made work' and can usually be prosecuted at a flexible rate according to the amount of labour available, and can be curtailed when necessary without detracting from the value of the work already done. They have a further advantage in that they do not compete with private enterprise. In addition to tree planting, and cultural operations, the Forest Service is responsible, *inter alia*, for fire protection, the improvement of forest ranges, and the construction of forest roads.

The author believes that it is neither necessary nor desirable to restrict public works to federal and other public lands. The Federal Government has already taken a large part in the protection of all forest lands from fire, insects and disease, and subsidies have been provided for forest planting on farm lands. It seems particularly desirable that the federal programme should include measures for keeping private forest lands in a productive state and for making good forest practice attractive to private owners. It is unlikely that the present trend of forest destruction and deterioration will be checked until effective public control of cutting and related practices is applied throughout the country.

In conclusion, the author recommends an extension of the acreage of forest lands under public ownership through the acquisition by the State of areas of special recreational value, of watersheds, and of forest lands which, because of low productivity or past abuse, will not be managed for continuous production if left in private hands.

91 (73) : 60.31 : 32. COLLINGWOOD, G. H. **Functions of industry in wildlife and forest management.** *Trans. 9th N. Amer. Wildlife Conf.* 1944 (13–8). [National Lumber Manufacturers Association, Washington, D.C.] [1481].

One hundred and forty million acres of forest land in the United States are without organized

protection and need the enactment of State laws to place all forest lands under fire protection and to enforce timber cutting and forest practices which will ensure continuous forest production. The National Lumber Manufacturers' Association is encouraging the prosecution of these aims by inviting owners to register their forest properties as 'tree farms'. Over 500 tree farms, comprising some 9 million acres, have already been registered. These farms, which are dedicated to the growing of forest crops for commercial purposes, are fire-protected and managed for continuous production. The common goal of wildlife management and forest management is fire protection and the application of cutting practices for continuous forest production, and timberland owners who are affiliated with the National Lumber Manufacturers' Association have pledged their efforts towards this end.

91.5 (71.4). GÉRIN, M. Colonies forestières dans le comté de Rimouski. [**Forest colonies in the county of Rimouski.**] *For. québec.* 10, 1945 (155–70). [F.] [1482].

Over most of the Province of Quebec the possibilities of agricultural colonization have reached a limit, and forest colonization provides the only opening for fresh settlements. In Rimouski county there is scope for 42 such colonies comprising a total of 1,103,038 acres. The establishment of a forest colony requires: (1) the exact demarcation of agricultural and forest lands; (2) division of forest land into sections taking into account river basins and the extent of forest necessary for the support of a colony of at least 50 families (between 25,000 and 30,000 acres); (3) prevention of present holders of forest concessions from over-exploitation pending the establishment of forest colonies; (4) development of an adequate system of forest roads; (5) creation of a forest protection service.

91.7 (485) : 09.4 : 91.8 : 98. LÜBECK, R. Skogens roll i uppländskt näringsliv. [**The rôle of the forest in the economic life of Uppsala County.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (378–91). [Sw.] [1483].

There are 279,000 ha. of productive forest (53 per cent. of the total land area) in Uppsala; the percentage composition of this by ownership is 16·2 State and communal, 35·4 company, and 48·4 other private forests. Of the last-named only 24 per cent. exceed 200 ha. The proportion of company and district-communal forests is unusually high for Sweden. In 1937 the annual cut was 835,800 cu.m. or approximately 3·0 cu.m. under bark per ha. The forests contain a high proportion of large-diameter timber, and the two most important assortments are timber and pulpwood. The cut of the former is low, and of the latter very high in comparison with other counties. In State forests, and to a lesser degree in communal and small private forests, the chief assortments are timber and fuelwood, whereas in company forests the bulk of the cut is pulpwood and timber. The seasonal claims of agriculture and forestry upon labour are reasonably well balanced. Only 14 per cent. of forest workers are permanently employed in the woods. The out-turn is largely converted at sawmills and pulp factories within the county, which also convert large quantities of timber from other regions: in 1935 the value of the output from wood industries was 5·9 per cent. of that for the whole of Sweden, and 23 per cent. of the industrial workers of the county were occupied in these industries. Improvements such as road building and drainage works have made good progress. During the war fellings have considerably exceeded increment, but, in part, this has improved the condition of forests in need of silvicultural cuttings.

94. FOREST OWNERSHIP. CO-OPERATIVES

94.12 (485). WIGELIUS, A. Gemensamhetsskogar—kommunskogar. [**Community forests.**] *Skogen* 32, 1945 (86, 87–9). [Sw.] [1484].

The establishment of community forests is one way of bringing uneconomic units of forest land under effective management. The Forest Society (*Skogssällskapet*), formed in 1912, serves the 14 southern counties of Sweden and has always sought to interest local government bodies and trusts in community forests. Such bodies have acquired lands of very diverse extent (50–1,500 ha.) and nature (often heath or peatland or overworked forest), representing investments of up to ½ million kr. in the case of county forests. The acquisitions have usually been financed by loans. The Forest Society works in close co-operation with the administrative bodies concerned; the communal

forests associated with it now number 190 with a total area of approximately 64,000 ha., and if certain forests belonging to foundations, associations and public institutions are included, the society serves a total area of some 90,000 ha. Though much of the work involved has been afforestation or improvements such as drainage and road building, the rate of progress has been good, largely owing to the provision of work for the unemployed in times of depression.

94.3 (47.1) : 97 : 06.1. RÄSÄNEN, K. Centraliseringen av skogsvårdsföreningarnas ekonomiska verksamhet i Finland. [**Centralization of the economic activities of the Local Forestry Associations in Finland.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (428–30). [Sw.] [1485].

The Local Forestry Associations (owners' associations), which had previously organized themselves into 17 Unions whose spheres of activity roughly corresponded with those of the District Forestry Boards (State-supported), have been centrally represented since late 1942 by a 'Forest Delegation' working under the Central Union of Agricultural Producers. The Delegation is composed of one representative for each Union of Local Forestry Associations, three for the Central Forestry Association, and six for agricultural producers' organizations; thus the Local Forestry Associations have a majority of about one-third. The Delegation forms a central co-ordinating body for private forest policy and economics from the owners' point of view; further, the Delegation is developing a central marketing organization working in close collaboration with the Local Forestry Associations.

94.3 : 92 (485). Fyra decennier i skogsvårdens tjänst. [**Four decades in the service of forestry.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (373–7). [Sw.] [1486].

A brief historical note on the rôle of the County Forestry Boards in connexion with Swedish legislation on private forestry. In 1944 the 25 Boards employed 536 whole-time and 1,048 casually employed persons, and handled funds amounting to about 9 million kr. At present an official review is being made of the activities, financing and organization of the Boards.

94.4 (489) : 94.34 : 96.4. KRARUP, F. Die Kleinwaldordnung in Dänemark. [**The management of small forest estates in Denmark.**] *Intersylva* 3, 1943 (509–18). [G.g.e.span.f.it.] M.E.W. [1487].

An account is given of the beginnings and development of small forest estate associations in Denmark. By an Act of 1919, associations of small forest estates with a membership of at least 25 forest owners and covering a net forest area of at least 1,000 ha., may receive State allowances for the salary of their advisers; the net forest area of the individual estates must not exceed 50 ha. Although the State allowances are very small, the Act has encouraged development, so that in 1942 12 associations were in existence, with a membership of 2,661 owners and a net forest area of 19,200 ha. The total area of forests and plantations of less than 50 ha. in Denmark amounts to 90,000 ha.; of these, however, 38,000 ha. are under the supervision of the Danish Heath Society, so that there remain only about 52,000 ha., of which 20,000 ha. consist of estates of less than 5 ha. Membership of a small forest estate association conveys certain advantages to the forest owners with regard to State supervision over the management of the forests. The statutes of the various associations are almost identical, as they all have to be approved by the Ministry of Agriculture. Relations between forest owners and advisers are good, and though it is left to the discretion of the owner to act on the suggestions of the adviser, this is almost always done, the forest owners having gradually become aware of the resulting advantages. *From author's summary.*

95. FOREST TAXATION. LOANS AND INSURANCE

95.3 (75 : 76). GAINES, E. M. **The forest credit program in the South.** *J. For.* 43, 1945 (580–4). [U.S. Forest Service, Southern Region, Atlanta, Ga.] [1488].

The forest credit programme of the Farm Credit Administration is now in operation in the southern United States. The writer explains its general character and objectives. The Federal Land Banks of Columbia and New Orleans are now providing long-term, low-interest loans, and the initial loans have been made on a conservative basis and with recognition of the desirability of good forest management. Loans are not available to corporations or to the large owner who needs more than $57,500 in credit. Details are given of

some of the properties and the terms on which loans have been made to their owners.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

97.2 (67.5) : 11.2 : 91.3. THOMAS, R. Les limites climatiques de la cuvette congolaise et le système forestier Bantou envisagés sous l'angle de la protection de la forêt. [**The climatic boundaries of the Congo Basin and the Bantu forest system from the point of view of forest protection.**] *Bull. agric. Congo belge* 33, 1942 (486–99) + map. [F.] [1489].

The first part of the article discusses the climatic boundaries of the middle Congo basin, which do not exactly coincide with the extension of the tropical rain forest. Parts of that forest are situated on higher ground and in drier microclimates. The vast extent of this forested basin (about 1 million sq. km.) creates what may be properly called a climate, rather than a microclimate, and there can be no doubt that the rainfall and the forest are mutually influential. The indigenous Bantu system of shifting cultivation on long rotations, with fallow periods up to five times as long as the periods of cultivation, is described, and it is concluded that, having regard to all the circumstances, there is no danger in it so far as the true Congo basin is concerned. On the higher, drier areas at the edges, however, the danger of erosion and spread of savanna conditions is present, and these areas, together with the considerable areas at present more or less continuously flooded, should be constituted permanent forest reserves. Research is necessary to discover the minimum desirable periods of rotation and the extent of forest necessary to support a native community on a system of shifting cultivation without upsetting the natural equilibrium of climate, soil and vegetation. It is suggested that, assuming a population of 4 to the sq. km. (which is more than actually exists) and a provision of 25 ha. for each family, 75 per cent. of the area of the basin could remain under permanent forest. Of the remaining 25 per cent., at any given time one-fifth would be cultivated and four-fifths forest fallow. [Cf. *For. Abstr.* 7 (No. 1186).]

97.2 (71) : 32.1 : 35. MULLOY, G. A. **Marking and markets for farm woodlots.** *Pulp Paper Mag. Can.* 46, 1945 (622–3). [Dominion Forest Service, Ottawa.] [1490].

The principal difficulty experienced by farmer owners of woodland is in the marking and marketing of the forest crop, and it is urged that there should be in every district a forestry representative whose duties should consist in large part in marking the farmers' woodlots for cutting, advising them on markets and even arranging for contacts between buyers and sellers.

97.2 (73). PHILLIPS, G. R. **Farm forestry.** *J. For.* 43, 1945 (471–6). [U.S. Department of Agriculture, Washington, D.C.] [1491].

Some 3½ million farmers own 185 million acres of farm woodland in the United States, or about 30 per cent. of all the forested land in the country. Nearly 139 million acres of this land are classed as commercial and over 46 million as non-commercial. In general, the commercial farm woodlands are situated on better soils than are the woodlands of similar classification in non-farm and public ownership, so that their potential productive capacity is relatively high. They are also situated closer to markets. Over 92 per cent. of all farm woodlands are east of the Great Plains, and about 50 per cent. of them are in the Southern States. They furnish nearly one-fourth of the sawlog supply in the United States, about one-third of the pulpwood and large quantities of fuelwood, fence posts and other products. Large numbers of farm woodlands are in a degraded condition as a result of over-cutting, over-grazing, burning and neglect. Average annual increment per acre is variously estimated at from one-fourth to one-half the potential, and this without reference to the relatively low-grade species on which much of it is produced. It is estimated that about 30 per cent. of the commercial farm woodlands are being well managed, though some 75 per cent. of these are to some degree deficient in their basic growing stock.

The paper reviews the legislation and other measures which have been taken to improve this situation, and stresses the need to instil into the farmers the desire to manage their woodlands properly.

97.2–3 (485) : 96.5. Skogsvård och betesförbättring i Norrland. Norrlandskommitténs förslag till vissa åtgärder för främjande av

skogsvård och betesförbättring i norra Sverige. **[Forest conservation and improvement of pasturage in Norrland. The Norrland Committee's proposals for certain measures to promote forest conservation and the improvement of pasturage in northern Sweden.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (93–6). [Sw.] [1492].

A report on proposed increases in subsidies for conservative forestry and cultivated pastures.

97.3 (729) : 11.62.11. STOCKDALE, SIR F. **Development and welfare in the West Indies, 1943–44.** H.M. Stationery Office, London. 1945. pp. 115. Colonial No. 189. [1493].

Grass-clad mountain slopes and gently undulating downlands are a feature of several of the West Indian islands. Many of these lands were formerly under forest, but at the present time the pasturage has an important economic value. This makes it desirable to consider the retention of existing pastures on all but the steepest slopes or in situations where the protection of water supplies demands that a protected forest cover should be re-established (p. 35).

98. THE TIMBER MARKET

98 : 33.06 (485). Avsättningen av småvirke. **[Disposal of small wood.]** *Svenska Skogsv-Fören. Tidskr.* 43, 1945 (362–5). [Sw.] [1494].

The war-time shortage of imported fuels has been of benefit silviculturally since there has been ample opportunity for disposing of small Swedish-grown wood. The danger of a relapse with the return of peace has led various bodies to make representations to the government on this question, and parliament has now approved a programme for investigation of the possibilities of rationalizing the small-wood industry, improving wood-burning stoves, etc., and securing publicity for Swedish-grown fuelwood. The bodies concerned will be the Forestry Board, which will work in liaison with County Forestry Boards and other interested bodies, the Forest Research Institute, and the Academy of Engineering Science.

98.1 (4). CLINE, A. C. **A brief view of forest conditions in Europe.** *J. For.* 43, 1945 (627–8). [War Production Board, Washington, D.C.] [1495].

The writer was a member of a United States mission on timber for Europe, which visited Europe in May–July, 1945. He gives an account, in general terms, of forest conditions in Great Britain, France and Germany, so far as he observed them during his visit.

98.1 (68.9 : 67.5 : 67.8). SPEIGHT, W. L. **Timber in South Africa.** *Wood* 10, 1945 (272). [1496].

Notes on timber production in Southern Rhodesia, Belgian Congo and Tanganyika. It is emphasized that, throughout the continent, the supply of trained labour, transport, and sawmilling equipment is insufficient to meet the demand for timber which arose during the war-time closing of overseas sources of supply.

98.1 (68). KEET, J. D. M. **National timber supply in the post-war transition period.** *J. S. Afr. For. Ass.* No. 12, 1944 (33–6). [1497].

98.1 (71). CANADA. **Report of the Lands, Parks and Forests Branch for the fiscal year ended March 31, 1944.** *Repr.* from Annual Report of the Department of Mines and Resources, Canada. 1945 (61–107). [1498].

Average annual consumption and destruction of Canada's reserves of merchantable timber, during the ten-year period 1933–42, totalled 3,933 million cu. ft. of standing timber, viz., volume used, 2,789; merchantable timber burned, 444; destroyed by insects, etc., 700 millions of cu. ft. Approximately 71 per cent. of the total depletion was used and 29 per cent. destroyed. Replacement of average annual depletion requires an average growth rate of 14 cu. ft. per acre over the whole accessible productive forested area of Canada. This is not a high rate of growth, and a far higher depletion rate could safely be maintained if the forests were managed in accordance with sound forestry principles. But until greatly improved forestry practices are introduced, it is not felt that Canada can safely increase her output of forest products (pp. 96–7).

98.3 (410). **Our wood imports.** *Timb. Tr. J.* 174, 1945 (518–9). [1499].

Board of Trade figures showing the import and export trade of the United Kingdom cover the first half of 1945, and similar periods in 1944 and 1938 for purposes of comparison. Imports in the first half of 1945 amounted to £15,192,918, compared with £15,791,384 in the corresponding period of 1944 and £21,426,174 in one-half of the year 1938. Of this 1945 total, Canada supplied to the value of £11,916,132, the next largest source of supplies being the United States (£1,662,944).

FORESTRY THE WORLD OVER

References: 1. *Bush Builder*, New South Wales Forest Service. 2. *Crown Colonist*, London. 3. *Domestic Commerce*, Washington. 4. *Engineering*, London. 5. *Foreign Commerce Weekly*, Washington. 6. *New York Forester*, Albany, N.Y. 7. *Report of Board of Commissioners of Agric. and For. of the Territory of Hawaii.* 8. *Report of the Forest Administration of Sierra Leone for the year 1944.* 9. *Skogen*, Stockholm. 10. *Timber Trade Journal*, London. 11. *Timberman*, Portland, Ore. 12. *Times*, London. 13. *Trees*, Sta. Monica, Calif. 14. *West Coast Lumberman*, Seattle, Wash. 15. *Wood*, London. The numbers in brackets indicate the reference number and the date of publication of the newspapers or periodicals to which the annotations refer.

Belgian Congo. The Belgian Government, during the war, erected a quinine factory in the Kivu district to treat the Cinchona bark produced in that area. The manager of the factory states that it is now producing at the rate of 2,200 lb. of quinine salts a month, which is 50 per cent. more than the present consumption of the Congo. The output will double next year. The additional quinine will be applied to the prevention of malaria among the native population, and a special low-priced compound will be produced for that purpose. The cost of production is lower than the world price and will decrease with the expansion of the plant, which is operated on a non-profit-making basis (5; 6.10.45).

Brazil. A type of wood reported to resemble Balsa has been found in the State of Goiaz, Brazil, and shipments have been sent to São Paulo, where it is being used on a small scale in aero-dynamic work for the construction of models. The trees are said to grow in the south of the State in large numbers and in concentrated stands, which facilitates felling and shipment. Logs measure up to 30 in. in diameter, with the outer layers harder and heavier than those inside. The cost of the first shipment of some 18 tons was about $100, two-thirds of which was for transportation (5; 20.10.45).

Both the Brazilian Government and private industry have expressed interest in the exploitation of producer gas, and several commercial concerns have spent large sums in its investigation. In many parts of the interior, where fuel transport costs are often very high, producer gas, made from locally produced wood and charcoal, has been found economical. The Thermal Energy Commission of Brazil is constructing a special engine which will be interchangeable with normal petrol engines, the substitution being made in a few hours. It is believed that producer-gas installations will find many uses in small, low-powered, stationary units for farms, rural industries and the like. Study is being devoted to special types of engine which will eliminate loss of power, the most common solution to date being found in a larger engine with higher compression and larger reduction in drive (5; 27.10.45).

During the first half of 1945, Brazil exported 4,934 metric tons of Mahogany and Aguano wood valued at $180,106; 4,187 tons of Cedar valued at $170,457; and 112,781 tons of Pine valued at $7,595,832. The United States imported all the Mahogany and Aguano (5; 17.11.45).

British Honduras. In 1939 the Colony exported 416,268 cu. ft. of Mahogany (almost wholly logs) and 38,838 cu. ft. of Cedar logs, but the trade changed during the war, and in 1943 Mahogany exports were made up of 494,196 cu. ft. of logs and 239,858 cu. ft. sawn timber (2; Oct., 1945).

Burma. It is believed that the Japanese have done little to impair the forest yield, but the timber industry's equipment has been almost completely destroyed. Hundreds of elephants were killed by the Japanese, and they also removed the tusks from the bull elephants, thus making them useless for several timber operations. It takes at least 2 years to train a wild elephant for timber-trade work. Another difficulty is that no girdling of Teak has taken place for 3 years, and it will be 3 years after girdling before the trees can be extracted.

It is possible that, in the post-war period, greater attention will be paid to some other Burmese timbers, for instance, to the Mangrove forests of the Arakan district, the Pine forests of the hills, and mixed forests of Pine, Oak and Chestnut at lower altitudes.

To the Burmese the Bamboo is still the most useful of all timbers; its growth is very rapid and it attains its full height of 50 to 80 ft. in one year. The military authorities have used Bamboo to build barracks, and they have proved most successful, standing up well to the monsoons (**10**; 22.9.45).

Canada. It is claimed that Dr. J. A. Hartig has now perfected a chemical process for a simultaneous evacuation of sap and moisture from a tree log and their replacement with either colour, plastic impregnation, creosote or paraffin, through the veins or cellular structure of the log. The by-product recovery of saps, varying up to 35 gallons per log, for colloidal and medical purposes, offers many possibilities. It is claimed that the Hartig process can impart many new characteristics to wood; every shade of colour can be imparted, either through pure chemical reactions after penetration in the log, or by direct use of dyes. There are also commercial possibilities of vermin-, weather-, and water-proofing of lumber through impregnation with camphor, paraffin or creosote. The fixed investment cost of the machinery for the Hartig process is small compared with the volume of finished material obtained from the treated logs. One machine can process 10 logs of 20-40 in. diameter in a 7-hour day. Multiple units can treat 10 logs at a time with low requirement for manual labour (**14**; Sept., 1945).

There are 8 mills in British Columbia engaged in the manufacture of pulp and paper. The consumption of the various species of wood (in cords) during 1944 was as follows:—

Species	*Mechanical*	*Sulphite*	*Sulphate*
Spruce and Balsam	76,553	59,881	30,771
Hemlock	67,087	218,871	38,495
Jack Pine	—	—	7,338
Other species	13,067	18,975	25,700
Total	156,707	297,727	102,304

The paper mills produced 317,000 short tons of paper in 1944 (**5**; 17.11.45).

The biggest Davis raft ever towed from Queen Charlotte Islands to a British Columbia sawmill reached English Bay outside Vancouver recently. It contained 1,417 individual logs totalling 3,571,000 bd. ft. Over 2 miles of 1½ in. cable were used in building the raft, which drew 16 to 18 ft. of water and had about 14 ft. of height above the surface. The journey of more than 400 miles was accomplished in 12 days (**14**; Sept., 1945).

Establishment of the Saskatchewan Timber Board for the purpose of buying, selling, and distributing forest products has been announced. The Board will market lumber and forest products for enterprises desiring the service. It is likely that the old system of selling cutting rights for timber on Crown lands will be abandoned and that the Provincial Government will let contracts for the cutting and processing of this timber, with the product "socially owned" until it reaches the consumer (**5**; 24.11.45).

Central and South America. The importation by the United States of Mangrove (*Rhizophora mangle*) bark from Central and South America was 4,653,991 lb. in 1944. In Brazil, Columbia, Ecuador, and Venezuela new companies are utilizing the bark for exportation and the leaves, which deteriorate rapidly, for local tanning. The extract of Mangrove bark is used in blends to produce sole leather. *Rhizophora mangle* grows throughout the vast salt-water swamps and tidal rivers of tropical America within 20° of the Equator, from Southern Florida and Baja California to central Brazil, and is available in almost limitless quantities. The president of a company which recently began operations in Para, Brazil, estimates that 10,000 tons of Mangrove bark could be extracted annually for an indefinite period in his area alone (**5**; 27.10.45).

Chile. In order to encourage intensive reforestation and conservation in the south of Chile, the Chilean Ministry of Lands and Colonization is enlisting the co-operation of private growers. Forestry nurseries sell plants to growers, together with scientific instructions for their cultivation. Those

who purchase as many as 5,000 plants are entitled to a visit by a forestry specialist to determine the percentage of successful growth. If this quota conforms to forest standards fixed by the Ministry, 50 per cent. of the purchase price of the plants is refunded to the grower (**5**; 6.10.45).

Colonial Empire. The successful use of Balsa for Mosquito aircraft, Red Cross chests and life-saving equipment has stimulated a demand for Balsa in England. It is proposed to use it for partitions in houses, factories, and offices, as wall panelling for broadcasting studios, theatres, and cinemas, as a lining for refrigerator vehicles, and for other purposes for which its heat-, cold-, and sound-proof qualities make the wood particularly suitable. At present, 95 per cent. of the world's production comes from Ecuador. British Honduras exports small quantities, and in recent years the trees have been planted in Ceylon. The first consignment of Ceylon Balsa was recently sold to Australia at a highly remunerative price.

The weight specification for Balsa for Mosquito aircraft is not more than 10 lb. per cu. ft. Neither in British Honduras nor in Ceylon has it been found possible to grow Balsa weighing less than 11 lb. per cu. ft. The weight of the dried and seasoned woods depends largely upon the rapidity of growth of the trees, and the soil and climate of the forests of Ecuador cannot be matched elsewhere. Nevertheless, there is a keen demand for the heavier Balsa wood for peace-time products, and a London firm which would be prepared to contract for 200,000 cu. ft. of Balsa wood a year is endeavouring to encourage British Colonial growers.

In Ecuador, Balsa trees grow to a height of 60 to 90 ft. with a diameter of 20 to 25 in. in 7 or 8 years. They must be felled immediately they reach maturity, otherwise a tap root is formed, the trees are saturated, develop a water-heart and lose their commercial value. In British Honduras and Ceylon, the growth is rather slower, and ten years is a fair estimate of the time between planting and felling. This means that the product has little attraction for the colonial village cultivator, who looks for quicker returns. Government assistance would probably be required to establish Balsa on a large scale in any of the Colonies (**2**; Nov., 1945).

Finland. Yrjö Ilvessalo has recently stated that whereas for 1924-34 the annual cut in Finland averaged 36 million cu.m. and rose in the years just before the war to 40 million cu.m., the fellings planned for the present season are 43 million cu.m., a figure that is unlikely to be reduced for several years to come. Finland, moreover, has lost 3·2 million ha. (13 per cent.) of her forest area or 4·9 million cu.m. (11 per cent.) of the annual increment, now estimated at 39 million cu.m. The danger of the proposed fellings is mitigated to some extent by an accumulation of some 60 million cu.m., owing to reduced war-time felling, but this is again offset by the fact that on the actual felling areas the annual increment is only 31 million cu.m. The reserves accumulated during the war are mostly in outlying regions, and fellings in the southern and central districts will considerably exceed increment (**9**; 15.8.45).

France. French forests in general are not in as poor a condition as might be expected, since lack of transport during the occupation prevented extensive exploitation in mountains or less accessible regions. Present needs of timber are large. For example, the French railways have asked for 6½ million sleepers, an amount larger than the pre-war annual production of 5,800,000. Domestic production is contingent on transport and the availability of labour and is difficult to estimate, but it is expected to increase during the latter part of 1945. Total output in 1938 was about 10,300,000 cu.m., and imports amounted to 2,750,000, while consumption was about 12,300,000. In 1944 less than 30 per cent. of the total needs for wood are believed to have been felled. It is estimated that, during the occupation, the Germans took one-third of the entire timber production, while further large quantities of wood had to be used for purposes other than timber, e.g. tanstuffs, textile fibres, and shoe soles. 130,000 cu.m. annually were used for the last-mentioned purposes (**5**; 13.10.45).

Nearly 1,000 million bd. ft. of timber are estimated to have been destroyed by fire in the Landes during the late summer of 1945. Military aeroplanes have been offered for patrolling the Pine forests. The co-operation of the U.S. Forest Service is being sought in working out a plan of fire prevention and suppression. Production of turpentine and resin is still low (only about one-half of pre-war production) partly on account of the much higher wages being paid in the lumber industry (**5**; 27.10.45).

Germany. A formula for converting waste wood into a special form for obtaining dry yeast has been developed in Austria by a German scientist. Two plants in Mannheim and Regensburg had a monthly output of 800 tons before being damaged by Allied bombing. It is claimed that large-scale manufacture of this yeast would aid materially in alleviating the food problem of the immediate post-war years (**5**; 6.10.45).

Gold Coast. Plans for a vigorous forestry programme for the Northern Territories have been outlined by the Chief Conservator of Forests. In addition to assisting the conservation of water supplies and the prevention of erosion, the aim would be to supply the population with fuelwood and poles, and possibly to produce a limited amount of sawn timber. The programme of work consists primarily of selection, demarcation and maintenance of forest reserves, the establishment in each district of a silvicultural experimental area of about 50-60 acres, to be followed, as soon as results justify such a course, by the formation in each district of a demonstration plantation of 300-400 acres (**2**; Sept., 1945).

Local wooden sleepers are to be used in future for the railway instead of imported steel sleepers. During the recent extension of the railway to the bauxite deposits, the Forestry Department arranged for the supply of 130,000 pit-sawn sleepers. A plant for creosoting sleepers is to be installed (**2**; Nov., 1945).

Bibiani Ltd. gold mine has a bank of producer-gas engines, unlike most other gold mines in the Gold Coast, which are dependent on oil fuel. The firewood comes from a large concession adjoining the mining concession. The trees are felled, and the stems cross-cut, split and stacked by African contractors, care being taken not to fell valuable trees. After being measured, inspected and taken over by the company's representatives, the firewood is loaded on to narrow-gauge trucks for transport to the firewood dump. A network of many miles of narrow-gauge line gives access to most parts of the firewood concession. Traction was formerly by Diesel locomotives but new electric locomotives are taking their place. An extensive tree-planting programme has been started, and it is hoped that the new plantations, though smaller than the area hitherto worked, will supply all requirements (**2**; Oct., 1945).

The experiment in honey collecting, begun three years ago by the Forest Department at Juaso, has been a success. The collection, purification and supply of local honey and beeswax was organized in the first place as a practical experiment to demonstrate the possibilities of this village industry. The demand for the honey has been considerable (**2**; Oct., 1945).

Great Britain. An invention that contributed materially to the Allies' successful invasion of Normandy was the Sommerfield Track. Sommerfield Flex boards provide an easily portable temporary road over practically any type of ground, and can also be used as a means of extricating lorries bogged down in heavy mud. They are made in two types, 36 in. and 42 in. wide respectively, for the support of loads up to 10 tons and above 10 tons, the smaller type being composed of 1½-in. boards and the larger type of 2-in. boards. The principle is that of continuous yet flexible duck-boards, and the flexboards are made in individual lengths of about 9 ft. The steel ribbons are run divergently in each 9 ft. unit so that the closer spacing at one end can be fitted within the wider spacing at the end of the adjoining unit. Linkage is by means of 1-in. heavy-gauge tubular hinge pins, which fit into the looped ends of the flexible ribbons. Pickets pins to anchor the flexboard to the ground are driven through holes in the hinge pins. There are many possible peace-time uses for these flex-boards, particularly on building estates where building is taking place on unpromising sites and where unmade roads normally get badly cut up by heavy lorries. They can also be invaluable to farmers where vehicles have to be driven across wet fields or clay ploughland (**15**; Nov., 1945).

A wooden chalet, made in Switzerland of Swiss Pine and worked with an adze, was brought over in sections in 1826 and erected at Singleton Park, Swansea. The Swansea Corporation took it over in 1918 when it was overhauled and repainted. It has had nothing spent on it since, until a few months ago when it was repainted. The chalet has been in occupation the whole of its life and is in as good condition as when it was made (**15**; Oct., 1945).

The numbers of the Timber Corps formed as part of the Women's Land Army in 1942, rose at one time to about 5,000. The work done by the women was not restricted to timber measuring and census taking. They not only selected trees for telegraph poles, but also felled, trimmed and peeled

them, and millions of pitprops also, and built timber rafts and towed them across Highland lochs (**15**; Oct., 1945).

The Forestry Commission are commencing their first post-war planting season, and by April, 1946, some 50 million young trees will have been transplanted from the nurseries to the forests. This will add some 30,000 acres to the wooded area. The Commission's pre-war annual planting average was about 25,000 acres, but during the war it fell to less than 5,000 acres (**15**; Nov., 1945).

According to Ministry of Supply figures, the timber felled in Great Britain between the outbreak of war and June, 1945, amounted to about one-third of the hardwood and nearly two-thirds of the softwood originally standing (including amenity, shelter, hedgerow, etc., trees). The rate of production in September, 1943 (the year of peak production), was several times that for September, 1939 (**4**; 16.11.45).

Guatemala. The Guatemalan Ministry of Agriculture has announced new regulations under which contracts for lumber cutting will be awarded. Proposals for contracts must be put at public auction and will be given to the highest bidder. Contracts will be awarded for the cutting of a specified number of trees. Contractors must abide by the provisions of the Forestry Law and any regulations now in effect or issued in the future (**5**; 6.10.45).

Hawaii. Seeds from high quinine-yielding strains of *Cinchona ledgeriana* were smuggled out of the Philippines soon after the fall of Bataan and were germinated in Washington. The seedlings grown from these seeds were flown to Hawaii in 1944 and planted in nursery beds at Kona on 20 acres of land at an elevation of 2,000 ft., to serve as a reservoir of material for commercial plantings (**7**; Dec., 1944).

Holland. The Netherlands Government is appointing a commission to take charge of the re-afforestation of Holland. Before the war Holland was the least wooded land on the Continent, and only slightly more wooded than England. War-time destruction and the shortage of coal have reduced the area of growing timber from 8 per cent. to 6 per cent. of the national territory. An aspect often overlooked is the danger of the formation of desert land in a country where the soil is largely dry sand. In the middle of the last century, when the coastal woods near Haarlem were cut down, large areas were laid open to the sharp salty sea-winds and became infertile. The Dutch authorities are bearing in mind the disastrous examples of this in China, Africa, and the American Middle West, and have also learnt by experience the dangers of specialized timber cultivation. 'One of the most important conditions of the new afforestation', said the Prime Minister recently, 'is that we should have more mixed woods, which will be more beautiful, and in the long run more economically profitable than the often funereal-looking Pine plantations. Mixed woods, in which exotic conifers grow alongside native deciduous species, generally have a rich undergrowth (and therefore a varied bird-life), and our soil is suited to this type of woodland'. Timber must be produced as soon as possible. Formerly about 5 million cu.m. a year had to be imported for use as pit props, for making sabots, matches, and furniture, and for building, agriculture, and defences against the sea. Huge additional quantities are now required for rebuilding and restoration. It is hoped to plant with suitable trees about 320,000 acres of what is called moorland (though most of this is bare sand), and 8 per cent. of the north-east polder of the former Zuyder Zee will be allotted for conversion into woodland (**12**; 31.12.45).

Norway. During the war Norwegian foresters in Sweden had their own 'forest administration', subordinated to the Norwegian Department of Agriculture in London and the Norwegian Legation in Stockholm. Two Spruce nurseries were established in 1943, and most of the stock will have to be taken to Norway early in 1946 as 3/0 seedlings. Norwegians have worked as assistants to Swedish foresters and have attended Swedish forestry courses; besides this, a purely Norwegian forest school was set up and two higher courses and one foremen's course were held. A forest estate near Stockholm was bought and run exclusively by Norwegians (**9**; 1.10.45).

Norway's capacity for producing sawn timber is at least as great as it was before the war, when approximately 4,000 sawmills consumed an average of 70 million cu. ft. of timber annually and exported one quarter of the output. The Germans left the production equipment intact, but succeeded

in obtaining only a small part of the felling they demanded, and the Forestry Department estimates a 20-per-cent. increase of growth over felling since the German invasion in 1940 (**5**; 27.10.45).

Norwegian production of paper pulp at present represents only 33 per cent. of the normal. Prospects of improvement are very small, as only 1½ million cu.m. of pulpwood are available until the next floating season, whereas 4 million cu.m. would be needed to guarantee full production (**9**; 15.11.45).

Peru. The U.S. Department of Agriculture is continuing a survey of outstanding *Hevea* trees in the Peruvian jungle, in order to locate the best natural *Hevea* rubber areas and to obtain seed and grafting material from the most productive and disease-resistant trees. In co-operation with the Peruvian Ministry of Agriculture and the Peruvian Amazon Corporation, selection material is used for experimental plantings in Peru. By the end of June, 1945, 229 selections had been made from the jungles and from seedling progeny originating in all the main rubber-producing areas of Peru. Selection of jungle trees has been made chiefly in the Madre de Dios region (**5**; 10.11.45).

Philippines. Of the 162 sawmills operating in the Philippine Islands before the war, 73, including some of the largest mills, have been completely destroyed. It is probable that several of the remaining 89 sawmills will be found to be too badly damaged to warrant repair. The total daily capacity of the 162 mills before the war was 1,693,000 bd. ft. Lumber output for 1945 is estimated at about 150 million bd. ft., a mere fraction of the normal production (**5**; 17.11.45).

Scandinavia. Representatives of Norway, Sweden, and Finland met in Copenhagen, at the invitation of Danish foresters, in September, 1945, and approved preliminary proposals for a 'Scandinavian Forestry Union' to stimulate the exchange of technical knowledge and experience (**9**; 15.10.45).

Sierra Leone. The timber industry, which has greatly expanded during the war, is planning further developments. Before 1939 the colony imported most of the timber used but it is hoped, within a few years, to meet all requirements from locally grown timber. Proposals for development include the taking over of plant and materials from the Army, and the opening up of hitherto unworked forest areas. Two sawmills will be maintained at a capacity of 100,000 cu. ft per annum, and a further 100,000 cu. ft. will probably be produced by pit-sawyers. The opening up of the Dodo-Nimini forest, in the Kenema area, a request for which has been made by the tribal authorities, will necessitate the construction of 12 miles of road (**2**; Sept., 1945).

Some 1,400 squares of wood cut from roots and stems of *Rhizophora racemosa* have been sent to the United Kingdom for testing as a substitute for Hickory handles. Mangrove fuel delivered to the railway as 12-in. sawn billets totalled 3,243 tons in 1943. Mangrove wood has a high calorific value and it is claimed that two tons are the equivalent of one ton of good imported coal. The railway, though preferring coal, is now using Mangrove fuel extensively for short haulage and steam cranes.

A demonstration of shingle roofing was incorporated in a small timber depot office. Creosoted shingles were cut from Yawe (*Tarrietia utilis*), a locally grown species used for the purpose 100 years ago. So far, these shingles have stood up well to rainy and dry season conditions (**8**; 1945).

Sweden. During the war period there has been a strong demand for Oak and other hardwoods for industrial use. In January, 1945, a Society for Promoting the Cultivation of Oak (Sällskapet för ekodlingens befrämjande) was formed. Its task will be to encourage interest in the protection and care of isolated trees or groups of hardwoods, especially Oak, that are worth preserving for their value in the landscape or on aesthetic or historical grounds (**9**; 1.11.45).

The sawmills of Korsnäsbolag are to be completely reorganized to cut timber to order in the dimensions and quality required. All incoming logs will be assembled in a boom, sorted by dimensions, and then stored by assortments on land, where special precautions will be taken against degrade. This procedure should give free choice of material and reduce the number of sizes to be sawn at any given time. The sawn timber is to be sorted by size before entering the new drying kilns, whence it will be taken to a timber store of 12,000 stds. capacity, situated on a jetty whence it can be shipped direct. The mills are planned to work in two shifts the year round. The system will do away with an extensive timber yard, a fleet of 70 barges, and the long period required for air drying: it will cost

7 million Kr. to install, but will free 4 million Kr. of capital and save two-thirds of the labour formerly required for the same output (**9**; 1.11.45).

Fellings of cordwood for the year ending 30th June, 1945, were 35,034,000 stacked cu.m., of which 24,629,000 was fuel and charcoal wood and 10,405,000 pulpwood. This was only 70 per cent. of the felling programme for the period (**9**; 1.11.45).

United States. A new solution has been developed at Harvard University for use by army camouflage units to prolong the life of trees which have been cut down and set up again. The camouflage school reports success with the new product, which is sprayed on to trees, which are then placed in cans containing water. The process saves the trees from drying up, and makes them appear lifelike for two to six weeks after being cut down (**13**; Aug., 1945).

Research is being conducted in Florida on the development of a high-yielding Pine for the production of turpentine and resin and on chemical stimulation of resin-flow, also on the production of pulpwood from stumps, and tannin from scrub Oak. Tung oil is another promising industry. In 1940 there were 1,203,764 Tung trees of all ages in Florida and many thousands have been planted since then (**3**; Oct., 1945).

It is calculated that no fewer than 72 billion Hemlock loopers were at work defoliating coniferous trees on 12,000 acres in Clatsop County, Oregon, before dusting operations with DDT and lead arsenate were undertaken in July. The effectiveness of the dusting programme was proved when it was found that 4 × 4 ft. cloth screens placed under treated trees gathered an average of 400 fallen larvae each, 48 hours after the planes had spread their loads from tree-top levels (**11**; Sept., 1945).

The recently organized West Coast Forestry Procedures Committee has attempted to clear up confusion as to the status of re-stocking on logged-off land by defining a procedure for classifying such lands. It is proposed that the stocked quadrat concept shall be employed, the size and shape of the sampling unit to be optional, and stocking to be expressed on the basis of 1/250-acre quadrats either in percentage of quadrats stocked or in 4 relative classes. A quadrat shall be considered stocked if it supports one or more established seedlings. The Committee is now working on the definition of other forestry techniques and practices, such as tree and log classes for Douglas Fir cruising, volume- and yield-table standards, standardized tree names, fuel types, and fire-danger rating (**11**; Sept., 1945).

The Gypsy Moth (*Lymantria dispar*), which for many years has been a serious forest and shade-tree pest in New England, is now a real problem in New York State. From 1923 to 1938 the Conservation Department, through its Bureau of Forest Pest Control, maintained a gypsy-moth barrier zone which proved, up to 1939, to be very effective in preventing the spread of this insect into New York State. In 1939 an unprecedented spread of the gypsy moth occurred and numerous colonies were established both within and west of the barrier zone. It is believed that, unless extensive control measures are taken, the gypsy moth will become a real nuisance in New York State. Experiments have shown that 100-per-cent. control can be obtained by applying DDT at the rate of 1 lb. per acre, and large areas of woodland have been treated at a very low cost per acre (**6**; Oct., 1945).

U.S.S.R. Timber-rafting was making good progress on 1,500 rivers in the Soviet Union at the beginning of July, in spite of a late spring and shortage of labour. Many timber rafts were constructed before the ice broke up, so that rafting could begin immediately the break-up came. By the beginning of July more than one million cu.m. of timber had already arrived at the mouths of rivers in the Northern Dvina Basin. Many thousands of women are now engaged on the work (**5**; 10.11.45).

The Soviet Information Bureau, in reply to an enquiry by the Australian Friendship with Russia League, state that Australian Eucalypts are largely grown in western Georgia, where the climate and physical features in many respects resemble those of Tasmania and the south-east coast of Australia They have been planted for various purposes, such as the reclamation of marsh land, for shelterbelts, for the production of essential oils, and for pulp. Every possible measure is being taken to expand the Eucalypt plantations. Certain species of Australian Wattle (*Acacia* spp.) are also being grown, for the production of tannin (**1**; August, 1945).